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OFFICE OF PESTICIDE PROGRAMS

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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Technical Services Division of the Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

Publication of an abstract, annotation, or citation does not imply endorsement by the Environmental Protection Agency of the original article or of commercial materials, equipment, or processes mentioned therein.

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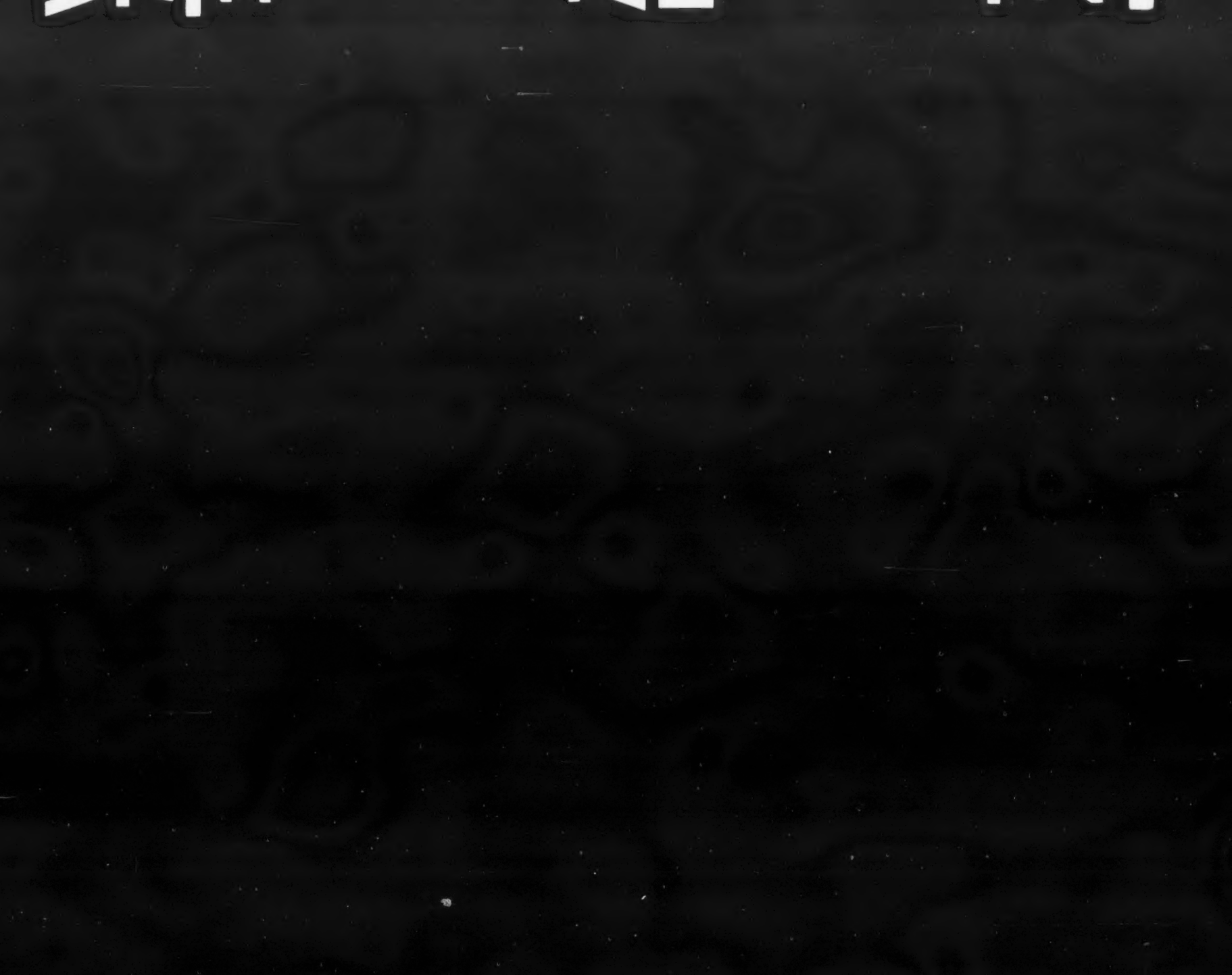

PESTICIDES ABSTRACTS

Preface

With the publication of Volume 7, *Health Aspects of Pesticides Abstract Bulletin* (HAPAB) has been renamed *Pesticides Abstracts* (PSTAB) in the belief that this title more accurately represents the scope and coverage of the journal.

Included in this issue is a list of sources from which at least one article was abstracted for publication in either Volume 5 (1972) or Volume 6 (1973); however, more than 2500 primary serials and secondary sources, books, and non-periodical publications are screened. Journal titles are abbreviated according to the format of *Chemical Abstracts Service Source Index Quarterly* (CASSI). Japanese publications are listed by the Hepburn romanization of the complete title which is followed by the English equivalent, abbreviated according to CASSI, in parentheses. For additional convenience, English titles of Japanese periodicals are listed separately and cross-referenced.

ACTA AGRON (PALMIRA)
ACTA ANESTHESIOL BELG
ACTA BIOCHIM IRAN
ACTA BIOL MED GER
ACTA BOT
ACTA CHEM SCAND
ACTA EMBRYOL EXP
ACTA ENDOCRINOL PANAMER
ACTA ENTOMOL BOHEMOSLOV
ACTA HEPATO-GASTROENTEROL
ACTA MED ACAD SCI HUNG
ACTA MED IRAN
ACTA MED IUGOSLAV
ACTA MED PHILIPP
ACTA MED POL
ACTA MED SCAND
ACTA MICROBIOL
ACTA MICROBIOL POL
ACTA NEUROL (NAPLES)
ACTA NEUROPATHOL
ACTA PAEDIAT SCAND
ACTA PARASITOL POL
ACTA PATHOL MICROBIOL SCAND
ACTA PHARM JUGOSLAV
ACTA PHARMACOL TOXICOL
ACTA PHYSIOL ACAD SCI HUNG
ACTA PHYSIOL POL
ACTA POL PHARM
ACTA VET (BRNO)
ACTA VET ENZYMOL
ACTA VET SCAND
ACTIV NERV SUPER
ADVAN ANAL CHEM INSTRUM
ADVAN APPL MICROBIOL
ADVAN CHEM SER
ADVAN INSECT PHYSIOL
ADVAN NEUROL SCI SEE SHINKEI KENKYU NO SHIMPO
AEROSP MED
AG ACTIONS
AGR AMER
AGR AVIAT
AGR BIOL CHEM (TOKYO)
AGR CHEM
AGR CHEM MON SEE KONGETSU NO NOYAKU
AGR ENG
AGR HORT SEE NOGYO OYOBI ENGEI
AGR MERCH
AGR MKT
AGR N IR
AGR POLLUT GR LAKES BASIN
AGR RES
AGRESSOLOGIE
AGRICHEM AGE
AGROCHEMIA (PRAGUE)
AGROCHIMICA
AGROHEMIJA
AGROKHIMIYA
AGRON J
AGRON TROP
AICHE IND PR DES WATER
AICHE SYMP SER
AIN SHAMS MED J
AKAD WISS LIT MAINZ ABH MATH-NATURWISS KL
AKITA J RURAL MED SEE AKITA-KEN NOSON IGAKKAI ZASSHI
AKITA-KEN EISEI KAGAKU KENKYU (AKITA PREFECT INST PUB HEALTH)
AKITA-KEN NOSON IGAKKAI ZASSHI (AKITA J RURAL MED)
ALIMENT VIE
ALLG FORSTZ
ALLIONIA
AMBIO
AMER CHEM SOC DIV WATER AIR WASTE CHEM GEN PAP
AMER DYEST REP
AMER FRUIT GROW
AMER IND HYG ASS J
AMER INST AERONAUT ASTRON
AMER J AGR ECON
AMER J CLIN NUTR
AMER J DIG DIS
AMER J DIS CHILD
AMER J ENOL VITICULT
AMER J EPIDEMIOL
AMER J MED TECH
AMER J NURS
AMER J OBSTET GYNECOL
AMER J OPHTHALMOL
AMER J PATHOL
AMER J PHYSIOL
AMER J PUB HEALTH
AMER J TROP MED HYG
AMER J VET RES
AMER LAB
AMER LUNG ASS BULL
AMER MIDL NATUR
AMER POTATO J
AMER REV RESP DIS
AMER SOC ANIM SCI PROC
AMER VEG GROW
AMER ZOOL
AN BROMATOL
AN INST CENT CERCET AGR BUCHAREST
AN QUIM
AN UNIV BUCURESTI
ANAL BIOCHEM
ANAL CHEM
ANAL CHIM ACTA
ANAL INSTRUM
ANAL LETT
ANALYSIS
ANALYST (LONDON)
ANAT ANZ
ANAT REC
ANDHRA AGR J
ANGEW CHEM INT ED ENGL
ANKARA UNIV TIP FAK MECM
ANKARA UNIV VET FAK DERG
ANN ACAD MED SINGAPORE
ANN APPL BIOL
ANN BIOL ANIM BIOCHIM BIOPHYS
ANN BULL INT DAIRY FED
ANN DIR ETUD EQUIP SEITA
ANN ENDOCRINOL
ANN ENTOMOL SOC AMER
ANN FAC AGR UNIV BARI
ANN FALS EXPERT CHIM
ANN GEMBLOUX
ANN INT MED
ANN MED VET
ANN N Y ACAD SCI
ANN NUTR ALIMENT
ANN PARASITOL HUM COMP
ANN PEDIAT SEE SEM HOP
ANN PHYTOPATHOL
ANN SCLAVO
ANN SOC BELG MED TROP
ANN TECHNOL AGR
ANN TROP MED PARASITOL
ANN ZOOL ECOL ANIM
ANNEE ENDOCRINOL
ANNU REP GUMMA PREFECT INST PUB HEALTH CENT STUDY ENVIRON POLLUT SEE GUMMA-KEN EISEI KENKYUSHO GUMMA-KEN KOGAI KENKYU SENTA NENPO
ANNU REP HIROSHIMA PREFECT SEE HIROSHIMA-KEN SHOWA 46 NENDO GYOMU NENPO
ANNU REP KANAGAWA PREFECT PUB HEALTH LAB SEE KANAGAWA-KEN EISEI KENKYUSHO NENPO
ANNU REP KUMAMOTO PREFECT INST PUB HEALTH SEE KUMAMOTO-KEN EISEI KENKYU SHOHO
ANNU REP MIE PREFECT INST PUB HEALTH SEE MIE-KEN EISEI KENKYUSHO NENPO
ANNU REP NAGASAKI PREFECT HYG LAB SEE NAGASAKI-KEN EISEI KENKYU NENPO
ANNU REP NARA PREFECT INST SEE NARA-KEN EISEI KENKYU SHOHO
ANNU REP OKAYAMA PREFECT PUB HEALTH LAB SEE OKAYAMA-KEN EISEI KENKYUSHO NENPO
ANNU REP SANKYO RES LAB SEE SANKYO KENKYUSHO NENPO
ANNU REP SHIMANE PREFECT INST PUB HEALTH SEE SHIMANE-KEN EISEI KENKYUSHO NENPO
ANNU REP TOKYO METROP LAB PUB HEALTH SEE TOKYO-TORITSU EISEI KENKYUSHO KENKYU NENPO
ANNU REP WAKAYAMA PREFECT INST PUB HEALTH SEE WAKAYAMA-KEN EISEI KENKYUSHO NENPO
ANNU REP SOC YAMAGUCHI IND HEALTH SEE YAMAGUCHI SANGYO IGAKU NENPO
ANNU REP YAMAGUCHI PREFECT RES INST SEE YAMAGUCHI-KEN EISEI KENKYUSHO NENPO
ANNU REP YAMANASHI PREFECT INST PUB HEALTH SEE YAMANASHI KENRITSU EISEI KENKYUSHO NENPO
ANNU REV BIOCHEM
ANNU REV ECOL SYST
ANNU REV MED
ANNU REV MICROBIOL
ANNU REV PHARMACOL
ANNU REV PLANT PHYSIOL
ANTONIE VAN LEEUWENHOEK J MICROBIOL SEROL
ANZ SCHAEDLINGSK PFLANZEN
APPL ENTOMOL ZOOL

APPL MICROBIOL
ARCH ANAT MICROSC
ARCH ARGENT PEDIATR
ARCH BIOCHEM BIOPHYS
ARCH DERMATOL
ARCH DERMATOL FORSCH
ARCH ENVIRON CONTAM TOXICOL
ARCH ENVIRON HEALTH
ARCH EXP VETERINAERMED
ARCH GEFLUEGELK
ARCH GESCHWULSTFORSCH
ARCH HISTOL SEE SAIBOKAKU BYORIGAKU ZASSHI
ARCH HYDROBIOL
ARCH IMMUNOL THER EXP
ARCH INST CARDIOL MEX
ARCH INST PASTEUR TUNIS
ARCH INT PHARMACODYN
ARCH INT PHYSIOL BIOCHIM
ARCH INTERN MED
ARCH LEBENSMITTELHYG
ARCH MAL PROF MED TRAV SECUR SOC
ARCH MIKROBIOL
ARCH NEUROL (CHICAGO)
ARCH OPHTHALMOL
ARCH PATHOL
ARCH PFLANZENSCHUTZ
ARCH PHARM (WEINHEIM GER)
ARCH SCI PHYSIOL
ARCH TOXIKOL
ARCH UNION MED BALKAN
ARCH VET ITAL
ARCISP S ANNA FERRARA
ARH FARM
ARH HIG RADA TOKSIKOL
ARH POLJOPR NAJKE
ARKANSAS FARM RES
ARM KHIM ZH
AROMATIKKUSU (AROMATICS)
ARQ INST BIOL (SAO PAULO)
ARZNEIM-FORSCH
ASIAN MED J
ASS FOOD DRUG OFF US QUART BULL
ATL SALMON J
ATMOS ENVIRON
ATTI SOC ITAL SCI VET
AUK
AUST CHEM PROCESS ENG
AUST J AGR RES
AUST J BIOL SCI
AUST J DAIRY TECHNOL
AUST J EXP AGR ANIM HUSB
AUST J ZOOL
AUST N Z J MED
AUST VET J
AUSTRALAS RADIOL
BACTERIOL PROC
BACTERIOL REV
BAIOTEKU (BIOTECH)
BAMIDGEH
BEITR GERICHTL MED
BEITR PATHOL ANAT ALLG
BEITR TABAKFORSCH
BENDIX TECH J
BER KERNFORSCHUNGSANLAGE JUELICH
BER LANDWIRT
BERUFS-DERM
BIBL HAEMATOL
BIOCHEM BIOPHYS RES COMMUN
BIOCHEM J
BIOCHEM PHARMACOL
BIOCHEM PHYSIOL PFLANZ
BIOCHEMISTRY
BIOCHEMISTRY (TOKYO) SEE SEIKAGAKU
BIOCHIM BIOPHYS ACTA
BIOCHIMIE
BIO-DYNAMICS
BIOKHIMIYA
BIOL CHEM VYZ ZVIRAT
BIOL CONSERV
BIOL NAUKI
BIOL RUNDSCH
BIOL ZENTRALBL
BIOL ZH ARM
BIOLOGICO
BIOSCIENCE
BIOTECH SEE BAIOTEKU
BIOTECHNOL BIOENG
BIOTROPICA
BIRD STUDY
BITKI KORUMA BUL
BIUL INST OCHR ROSL
BLUE JAY
BOCHU-KAGAKU (SCI PEST CONTR)
BODENKULTUR
BOL CHIL PARASITOL
BOL OF SANIT PANAMER
BOL SOC QUIM PERU
BOLL CHIM FARM
BOLL LAB CHIM PROV
BOLL SECT PLAGUICIDAS CENT TOXICOL UNIV NAC B AIRES
BOLL SOC ITAL BIOL SPER
BRAIN NERVE SEE NO TO SHINKEI
BRATISLAV LEK LISTY
BRIT FOOD J
BRIT J ANAESTH
BRIT J CLIN PRACT
BRIT J DERMATOL
BRIT J EXP PATHOL
BRIT J HAEMATOL
BRIT J IND MED
BRIT J PHARMACOL
BRIT MED J
BRIT POULT SCI
BRIT VET J
BROMATOL CHEM TOKSYKOL
BUDAPESTI KOZEGISZEGUGY
BUL SHKENCEAVE BUJQESORE
BULL ACAD NAT MED PARIS
BULL ACAD POL SCI
BULL ACAD SCI KOREAN PEOPLE'S DEMOCRAT REPUB SEE CHOSON MINJUJUUI INMIN KONGHWAGUK KWAHAGWON TONGBO
BULL ACAD VET FR
BULL AGR CHEM INSP STA
BULL AVES
BULL CANCER
BULL CHEM SOC JAP
BULL ENTOMOL SOC AMER
BULL ENTOMOL SOC CAN
BULL ENTOMOL SOC NIGER
BULL ENVIRON CONTAM TOXICOL
BULL EXP BIOL MED (USSR)
BULL GOV FOREST EXP STA SEE RINGYO SHIKENJO KENKYU HOKOKU
BULL GRAIN TECHNOL
BULL HIST MED
BULL HYOGO PREFECT PUB HEALTH LAB SEE HYOGO-KEN EISEI KENKYUSHO KENKYU HOKOKU
BULL INST CHEM RES KYOTO UNIV
BULL INST PUB HEALTH (TOKYO) SEE KOSHU EISEIIN KENKYU HOKOKU
BULL JAP SOC SCI FISH SEE NIPPON SUISAN GAKKAISHI
BULL KAGAWA PREFECT AGR EXP STA SEE KAGAWA-KEN NOGYO SHIKENJO KENKYU HOKOKU
BULL KANAGAWA PUB HEALTH LAB SEE KANAGAWA-KEN EISEI KENKYUSHO KENKYU HOKOKU
BULL MED LEG TOXICOL MED
BULL MENS SOC LINN LYON
BULL MT DESERT ISL BIOL LAB
BULL NAT INST HYG SCI TOKYO SEE EISEI SHIKENJO HOKOKU
BULL PHYSIO-PATHOL RESP
BULL SCI CONS ACAD SCI ARTS RSF YOUGOSLAVIE SECT A
BULL SOC CHIM FR
BULL SOC FR DERMATOL SYPHILIGR
BULL SOC PHARM MARSEILLE
BULL SOC SCI VET MED COMP
BULL SOC ZOOL FR
BULL WHO
BUNDESGESUNDHEITSBLATT
BUNSEKI KAGAKU (JAP ANAL)
BYULL EKSP BIOL MED
BYULL VSES NAUCH-ISSLED INST
C R ACAD SCI PARIS SER D
C R ASS ANAT
C R SEANCES ACAD AGR FR
C R SEANCES MENS SOC SCI NATUR PHYS MAROC
C R SOC BIOL
CAFE CACAO THE
CAH MED
CAH NUTR DIET
CALIF AGR
CALIF FISH GAME
CALIF HEALTH
CAN ENTOMOL
CAN FIELD-NATUR
CAN INST FOOD TECHNOL J
CAN J ANIM SCI
CAN J BIOCHEM
CAN J BOT
CAN J CHEM
CAN J COMP MED
CAN J GENET CYTOL
CAN J MICROBIOL
CAN J PHARM
CAN J PHYSIOL PHARMACOL
CAN J PLANT SCI
CAN J PUB HEALTH
CAN J SOIL SCI
CAN J ZOOL
CAN MED ASS J
CAN VET J
CAN WILDL SERV REP
CANCER
CANCER CHEMOTHER REP
CANCER (TOKYO) SEE GANN
CANCER RES
CARBON (OXFORD)
CENT AFR J MED
CEREAL CHEM
CERES
CESK FYSIOL
CESK HYG
CESK PATOL
CEYLON COCONUT QUART
CHEM AGE INDIA
CHEM ANAL (WARSAW)
CHEM-BIOL INTERACTIONS
CHEM BRIT
CHEM CHEM IND SEE KAGAKU TO KOGYO (TOKYO)
CHEM COMMUN
CHEM CONTR RES INST
CHEM ECON ENG REV
CHEM ENG (LONDON)
CHEM ENG NEWS
CHEM IND (LONDON)
CHEM IND (TOKYO) SEE KAGAKU KOGYO
CHEM-ING TECH Z
CHEM LISTY
CHEM PHARM BULL
CHEM PRUM
CHEM RUNDSCH
CHEM SCR
CHEM TECH (AMSTERDAM)
CHEM TECH (LEIPZIG)
CHEM TECHNOL
CHEM UNSERER ZEIT
CHEM WEEK
CHEM WEEKBL
CHEM ZVESTI

CHEMISTRY
CHEMOSPHERE
CHESAPEAKE SCI
CHIM ANAL (PARIS)
CHIM IND GENIE CHIM
CHOSON MINJUJUUI INMIN KONGHWAGUK KWAHAGWON TONGBO (BULL ACAD SCI KOREAN PEOPLE'S DEMOCRAT REPUB)
CHROMATOGRAPHIA
CIRC RES
CITRUS IND
CITRUS VEG MAG
CIV ENG (NEW YORK)
CLIN ALL-ROUND SEE SOGO RINSHO
CLIN BIOCHEM
CLIN CHEM
CLIN CHIM ACTA
CLIN ELECTROENCEPHAL SEE RINSHO NOHA
CLIN MED SEE SHINRYO TO HOKEN
CLIN NEUROL SEE RINSHO SHINKEIGAKU
CLIN OPHTHALMOL SEE RINSHO GANKA
CLIN PEDIAT
CLIN PHARMACOL THER
CLIN RADIOL
CLIN TOXICOL
CLIN TOXICOL AGR PESTIC
CLIN VET
COLLECT CZECH CHEM COMMUN
COLUMBIA LAW REV
COMMUNITY HEALTH
COMP BIOCHEM PHYSIOL
COMP GEN PHARMACOL
COMPOST SCI
CONCOURS MED
CONDOR
CONGENITAL ANOMALIES SEE SENTEN IJO
CONN AGR EXP STA BULL
CONSUM REP
CONTEMP AGR
CONTRIB IST RIC AGRAR MILAN
COPEIA
COTON FIBRES TROP
CRIT REV ANAL CHEM
CRIT REV ENVIRON CONTR
CRIT REV MICROBIOL
CRIT REV TOXICOL
CROPS SOILS MAG
CURR FARM ECON
CURR SCI
CZAS STOMATOL
CZ-CHEM-TECH
DAN KEMI
DAN ORNITHOL FOREN TIDS
DAN TIDSSKR FARM
DEL MED J
DEUT GESUNDHEITSW
DEUT GEWASSERK MITT
DEUT LEBENSM-RUNDSCH
DEUT MED WOCHENSCHR
DEUT MILCHWIRT
DEUT TIERAERZTL WOCHENSCHR
DEVELOP BIOL
DEVELOP IND MICROBIOL
DEVELOP PSYCHOBIOL
DISS ABSTR INT
DISS PHARM PHARMACOL
DOKL AKAD NAUK SSSR
DOKL AKAD NAUK TADZH SSSR
DOKL BIOL SCI
DOKL BOLG AKAD NAUK
DOKL SEL'SKOKHOZ AKAD SOFIA
DOKL TSKHA (TIMIRYAZEV SEL'SKOKHOZ AKAD)
DOKL VSES LENINGRAD AKAD SEL'SKOKHOZ
DOPOV AKAD NAUK UKR RSR SER B
DOWN EARTH
DRUG INFORM J
DRUG METAB DISPOSITION
DRUG METAB REV
E AFR MED J
ECOL MONOGR
ECOL TODAY
ECOLOGY
ECON MED ANIM
ECON PLANN
EDISON ELEC INST BULL
EFFLUENT WATER TREAT J
EGESZSEGTUDOMANY
EISEI KAGAKU (J HYG CHEM)
EISEI SHIKENJO HOKOKU (BULL NAT INST HYG SCI)
EIYO TO SHOKURYO (FOOD NUTR)
EKSP MED MORFOL
EKSP VOD TOKSIKOL MATER VSES SIMP
ELECTROENCEPHALOGR CLIN NEUROPHYSIOL
ELECTROENCEPHALOGR ELECTROMYOGR SEE NOHA TO KINDENZU
ELELMISZERVIZSGALATI KOZLEM
EMERGENCY MED
ENDOCRINOL EXP
ENDOCRINOLOGY
ENVIRON AFF
ENVIRON CONTR
ENVIRON DESTRUCT SEE KANKYO HAKAI
ENVIRON ENTOMOL
ENVIRON HEALTH PERSPECT
ENVIRON LETT
ENVIRON PHYSIOL BIOCHEM
ENVIRON POLLUT
ENVIRON QUAL NOTE
ENVIRON RES
ENVIRON SCI TECHNOL
ENVIRONMENT
EOS TRANS AMER GEOPHYS UNION
ERNAEHRUNGSFORSCHUNG
ERNAEHRUNGSUMSCHAU
ETHIOP MED J
EUR J BIOCHEM
EUR J CLIN PHARMACOL
EUR J PHARMACOL
EUR J TOXICOL
EURO-SPECTRA
EXP AGR
EXP AGR ANIM HUSB
EXP CELL RES
EXP EYE RES
EXP MOL PATHOL
EXP PATHOL
EXPERIENTIA
FAO PLANT PROT BULL
FARM CHEM
FARM POL
FARM TECHNOL AGRI-FIELDMAN
FARM ZH (KIEV)
FARMACO (ED PRAT)
FARMACO (ED SCI)
FARMAKOL TOKSIKOL (MOSCOW)
FARMATSIYA (MOSCOW)
FARMERS WKLY
FARMING S AFR
FARUMASHIA (PHARMACY)
FDA (FOOD DRUG ADMIN) PAP
FED EUR BIOCHEM SOC LETT
FED PROC
FEL'DSHER AKUSH
FETTE SEIFEN ANSTRICHM
FIRE COMMAND
FISH BULL
FIZIOL AKTIV VESHCHESTVA
FIZIOL BIOKHIM KUL'T RAST
FIZIOL NORM PATOL
FIZIOL RAST
FIZIOL ZH (KIEV)
FLEISCHWIRTSCHAFT
FLUORIDE
FOED EUR GEWAESSERSCHUTZ INFORMATIONSBL
FOLIA BIOL (KRAKOW)
FOLIA BIOL (PRAGUE)
FOLIA ENTOMOL MEX
FOLIA HAEMATOL (LEIPZIG)
FOLIA HISTOCHEM CYTOCHEM
FOLIA MED BIALOSTOCENSIA
FOLIA MED CRAKOV
FOLIA MED (NAPLES)
FOLIA MED [PLOVDIV]
FOLIA MORPHOL (WARSAW)
FOLIA OPHTHALMOL JAP SEE NIPPON GANKA KIYO
FOOD COSMET TOXICOL
FOOD DRUG COSMET LAW J
FOOD MFR
FOOD NUTR SEE EIYO TO SHOKURYO
FOOD TECH AUST
FOREIGN COMPOUND METAB MAMMAL
FORENSIC SCI
FOREST CHEM SEE RINGYO TO YAKUZAI
FOREST CHRON
FOREST PHARM SEE RINGYO TO YAKUZAI
FORTSCHR WASSERCHEM IHRER GRENZGEB
FRESENIUS Z ANAL CHEM
FRESHWATER BIOL
FRUIT BELG
G IG MED PREV
GA AGR RES
GANKA (OPHTHALMOLOGY)
GANKA RINSHO IHO (JAP REV CLIN OPHTHALMOL)
GANN (CANCER)
GARTENBAU
GARTENBAUWISSENSCHAFT
GAS WASSER ABWASSER
GAS WASSER WAERME
GAS-WASSERFACH WASSER-ABWASSER
GAZ CUKROW
GAZ MED FR
GAZ WODA TECH SANIT
GDANSK TOW NAUK ROZPR WYDZ
GEKKAN YAKUJI (PHARM MON)
GENETIKA
GEOL SOC AMER BULL
GESUNDE PFLANZ
GESUNDH-ING
GETREIDE MEHL
GEWAESSERSCH WASSER ABWASSER
GIDROBIOL ZH
GIDROTEKH MELIOR
GIG PRIMEN TOKSIKOL PESTITS KLIN OTRAVLENII
GIG SANIT
GIG TR PROF ZABOL
GIT (GLAS-INSTRUM-TECH) FACHZ LAB
GLEAN BEE CULT
GORDIAN
GRASAS ACEITES
GROUND WATER
GRUNDLAGEN LANDTECH
GUMMA-KEN EISEI KENKYUSHO GUMMA-KEN KOGAI KENKYU SENTA NENPO (ANNU REP GUMMA PREFECT INST PUB HEALTH CENT STUDY ENVIRON POLLUT)
HAEMATOL BLUTTRANSFUS
HAKKO KOGAKU ZASSHI (J FERMENT TECHNOL)
HAREFUAH
HARYANA AGR UNIV J RES
HAUTARZT
HAWAII FARM SCI
HEALTH BULL
HIROSAKI IGAKU (HIROSAKI MED J)
HIROSAKI MED J SEE HIROSAKI IGAKU
HIROSHIMA-KEN SHOWA 46 NENDO GYOMU NENPO (ANNU REP HIROSHIMA PREFECT)
HISTOCHEMIE
HOARD'S DAIRYMAN
HOHENHEIMER ARB SCHRIFTEN UNIV HOHENHEIM ALLG REIHE
HOKENFU ZASSHI (JAP J PUB HEALTH NURSE)

HOKKAIDORITSU EISEI KENKYUSHO-HO (REP HOKKAIDO INST PUB HEALTH)
HOKORIKU BYOGAICHU KENKYU KAIHO (PROC SOC PLANT PROT HOKURIKU)
HOKUSUISHI GEPPO (J HOKKAIDO FISH SCI INST)
HOLZ ROH- WERKST
HOPPE-SEYLERS Z PHYSIOL CHEM
HORTSCIENCE
HOUSEHOLD PERS PROD IND
HRANA ISHRANA
HSMHA (HEALTH SERV MENT HEALTH ADMIN) HEALTH REP
HUM BIOL OCEANIA
HUMANGENETIK
HWAHAK KWA KONGOP UI CHINBO (PROGR CHEM CHEM IND)
HYDROBIOL J
HYDROBIOLOGIA
HYG SANIT (USSR) (TRANS OF GIG SANIT)
HYOGO-KEN EISEI KENKYUSHO KENKYU HOKOKU (BULL HYOGO PREFECT PUB HEALTH LAB)
IDEN (HEREDITY)
IDIA (INFORM INVEST AGR)
IEEE TRANS GEOSCI ELECTRON
IG MOD
IG SANIT PUBB
IGAKU NO AYUMI (PROGR MED)
IGAKU TO SEIBUTSUGAKU (MED BIOL)
IGIENA
IIRB (INST INT RECH BETTERAVIERES)
ILL NATUR HIST SURV BULL
ILL STATE WATER SURV CIRC
IMMUNOL COMMUN
IND ALIMENT (BUCHAREST)
IND ALIMENT (PINEROLO ITALY)
IND ALIMENT AGR
IND CONSERVE
IND MED SEE SANGYO IGAKU
IND MED SURG
IND RES
INDIAN EAST ENG
INDIAN J AGR SCI
INDIAN J ANIM SCI
INDIAN J APPL CHEM
INDIAN J BIOCHEM BIOPHYS
INDIAN J ENTOMOL
INDIAN J ENVIRON HEALTH
INDIAN J EXP BIOL
INDIAN J MED RES
INDIAN J MICROBIOL
INDIAN J PHYSIOL PHARMACOL
INDIAN J PUB HEALTH
INDIAN VET J
INDIANA AGR EXP STA INSP REP
INFEC IMMUNITY
INGENIEURSBLAD
INN MED IHRE GRENZGEB
INGUINAMENTO
INST ENVIRON SCI TECH MEET PROC
INT ARCH ARBEITSMED
INT CHEM ENG
INT DIG HEALTH LEGIS
INT J BIOCHEM
INT J CANCER
INT J DERMATOL
INT J ENVIRON ANAL CHEM
INT J ENVIRON SCI
INT J ENVIRON STUD
INT J NEUROSCI
INT PEST CONTR
INT ZOO YEARB
INTERN MED SEE NAIKA
INTERNIST PRAX
INVEST PESQ
IOWA STATE UNIV VET
IRYO (MED TREAT)
ISOTOPENPRAXIS
ISR J ENTOMOL
ISR J MED SCI
ITAL VINIC AGR
ITOGI NAUKI TEKH FARMAKOL KHIMIOTER SREDSTVA TOKSIKOL
IUGOSLAV PHYSIOL PHARMACOL ACTA
IZOTOPTECHNIKA
IZV AKAD NAUK SSSR SER BIOL
IZV AKAD NAUK SSSR SER KHIM
IZV INST FIZIOL BULG AKAD NAUK
IZV SEL'SKOKHOZ NAUK
J AGR CHEM SOC JAP SEE NIPPON NOGEI KAGAKU KAISHI
J AGR FOOD CHEM
J AGR SCI SEE NOGYO GIJUTSU
J AGR UNIV P R
J AIR POLLUT CONTR ASS
J ALA ACAD SCI
J AMER CHEM SOC
J AMER DIET ASS
J AMER MED ASS
J AMER MED WOMEN'S ASS
J AMER OIL CHEM SOC
J AMER PHARM ASS
J AMER SOC HORT SCI
J AMER SOC SUGAR BEET TECHNOL
J AMER VET MED ASS
J AMER WATER WORKS ASS
J ANAL CHEM USSR
J ANIM SCI
J APPL CHEM BIOTECHNOL
J APPL ECOL
J APPL PHYSIOL
J ARKANSAS MED SOC
J ASS OFFIC ANAL CHEM
J ASS PHYSICIANS INDIA
J ASS PUB ANAL
J AUST ENTOMOL SOC
J AUST INST AGR SCI
J BIOCHEM (TOKYO)
J BIOL CHEM
J BIOSOCIAL SCI
J CELL BIOL
J CELL SCI
J CHEM EDUC
J CHEM SOC D
J CHROMATOGR
J CHROMATOGR SCI
J CHRONIC DIS
J CLIN ENDOCRINOL METAB
J CLIN INVEST
J CLIN NUTR SEE RINSHO EIYO
J CLIN PHARMACOL J NEW DRUGS
J COMMUN DIS
J COMP PATHOL
J DAIRY SCI
J ECON ENTOMOL
J EGYPT MED ASS
J ENVIRON HEALTH
J ENVIRON QUAL
J EXP BOT
J FERMENT TECHNOL SEE HAKKO KOGAKU ZASSHI
J FISH RES BD CAN
J FLOUR ANIM FEED MILLING
J FOOD HYG SOC JAP SEE SHOKUHIN EISEIGAKU ZASSHI
J FOOD SCI
J FOOD SCI TECH (MYSORE)
J FOOD SCI TECHNOL (TOKYO) SEE NIPPON SHOKUHIN KOGYO GAKKAI-SHI
J FORENSIC MED
J FORENSIC SCI
J FOREST
J FORMOSAN MED ASS (T'AI-WAN I HSUEH HUI TSA CHIH)
J GA ENTOMOL SOC
J GEN APPL MICROBIOL
J GEN MICROBIOL
J HERED
J HISTOCHEM CYTOCHEM
J HOKKAIDO FISH SCI INST SEE HOKUSUISHI GEPPO
J HYG CHEM SEE EISEI KAGAKU
J HYG EPIDEMIOL MICROBIOL IMMUNOL
J INDIAN ACAD FORENSIC SCI
J INDIAN MED ASS
J INDIAN SOC SOIL SCI
J INSECT PHYSIOL
J INST BREWING LONDON
J INST MUNIC ENG
J INVERTEBR PATHOL
J INVEST DERMATOL
J IOWA MED SOC
J IR MED ASS
J JAP ACCIDENT MED ASS SEE NIPPON SAIGAI IGAKKAI KAISHI
J JAP ASS RURAL MED SEE NIPPON NOSON IGAKKAI ZASSHI
J JAP ASS THORAC SURG SEE NIPPON KYOBU-GEKA GAKKAI ZASSHI
J JAP BIOCHEM SOC SEE SEIKAGAKU
J JAP ELECTRON MICROSC SOC SEE NIPPON RINSHO DENSHI KEMIKYO GAKKAI-SHI
J JAP MED ASS SEE NIPPON ISHIKAI ZASSHI
J JAP OBSTET GYNECOL SEE NIPPON SANKA FUJINKA GAKKAI ZASSHI
J JAP OIL CHEM SOC SEE YUKAGAKU
J JAP OPHTHALMOL SOC SEE NIPPON GANKA GAKKAI ZASSHI
J JAP PHARMACOL
J JAP SOC AIR POLLUT SEE TAIKI OSEN KENKYU
J JAP SOC FOOD NUTR SEE EIYO TO SHOKURYO
J JAP VET MED SOC SEE NIPPON JUIGAKKAI ZASSHI
J KANS ENTOMOL SOC
J KURUME MED ASS SEE KURUME IGAKKAI ZASSHI
J KY MED ASS
J MAINE MED ASS
J MED ASS GA
J MED ASS STATE ALA
J MED ASS THAILAND
J MED AUST
J MED CHEM
J MED ENTOMOL
J MED LYON
J MED SOC N J
J MED SOC TOHO UNIV SEE TOHO IGAKKAI ZASSHI
J MILK FOOD TECHNOL
J NARA MED ASS SEE NARA IGAKU ZASSHI
J NAT CANCER INST
J NEUROCHEM
J NUCL MED
J NUTR
J OCCUP MED
J OHIO PUB HEALTH ASS
J OKAYAMA MED SOC SEE OKAYAMA IGAKKAI ZASSHI
J OKLA STATE MED ASS
J OPHTHALMOL SOC JAP SEE NIPPON GANKA GAKKAI ZASSHI
J ORG CHEM
J OSAKA CITY MED CENT SEE OSAKA SHIRITSU DAIGAKU IGAKU ZASSHI
J PAK MED ASS
J PATHOL
J PEDIAT
J PESTIC SCI SEE NOYAKU KAGAKU
J PHARM BELG
J PHARM PHARMACOL
J PHARM SCI
J PHARMACOGNOSY SEE SHOYAKUGAKU ZASSHI
J PHARMACOL
J PHARMACOL EXP THER

J PHYSIOL (LONDON)
J PUB NUISANCE SEE KOGAI TO TAISAKU
J RADIOANAL CHEM
J RANGE MANAGE
J REPROD FERT
J RES PUNJAB AGR UNIV
J RES US GEOL SURV
J ROY COLL PHYSICIANS
J ROY SOC ARTS
J S AFR VET MED ASS
J S C MED ASS
J SANIT ENG DIV AMER SOC CIVIL ENG
J SCI RES COUNC JAM
J SCI SOIL ANIM FERT JAP
SEE NIPPON DOJO HIRYOGAKU ZASSHI
J SHIKOKU PUB HEALTH SOC SEE
SHIKOKU KOSHU EISEIGAKU ZASSHI
J SOC COSMET CHEM
J SOIL SCI
J STORED PROD RES
J TAKEDA RES LAB SEE TAKEDA
KENKYUSHO HO
J TENN MED ASS
J THERM ANAL
J TROP MED HYG
J WASH ACAD SCI
J WATER POLLUT CONT FED
J WILDL MANAGE
J ZOO ANIM MED
J ZOOL
JAP ANAL SEE BUNSEKI KAGAKU
JAP FOOD SCI
JAP J APPL ENTOMOL ZOOL
SEE NIPPON OYO DOBUTSU KONCHU
GAKKAI-SHI
JAP J CLIN MED SEE NIPPON RINSHO
JAP J CLIN PATHOL SEE RINSHO BYORI
JAP J HYG SEE NIPPON EISEIGAKU
ZASSHI
JAP J IND HEALTH SEE SANGYO IGAKU
JAP J IND HYG SEE RODO EISEI
JAP J LEG MED SEE NIPPON HOIGAKU
ZASSHI
JAP J PHARMACOL
JAP J PUB HEALTH SEE NIPPON KOSHU
EISEI ZASSHI
JAP J PUB HEALTH NURSE SEE HOKENFU
ZASSHI
JAP J THORAC DIS SEE NIPPON
KYORUSHIKKAN GAKKAI ZASSHI
JAP J VET SCI SEE NIPPON JUIGAKU
ZASSHI
JAP J ZOOTECH SCI SEE NIPPON
CHIKUSAN GAKKAI-HO
JAP MED J SEE NIPPON IJI SHINPO
JAP PESTIC INFORM
JAP RADIOISOTOPE ASS NEWS SEE NIPPON
HOSHASEI DOIGENSO KYOKAI NYUSU
JAP REV CLIN OPHTHALMOL SEE GANKA
RINSHO IHO
JARQ (JAP AGR RES QUART)
JIKKEN DOBUTSU (EXPERIMENTAL
ANIMALS)
JNKVV RES J (JAWAHARLAL NEHRU KRISHI
VISHWA VIDYALAYA)
JOHNS HOPKINS MED J
JORNADAS ARGENT TOXICOL ANAL ACTAS
JUGOSLOV INOST DOK ZAST RADU
KAGAKU (TOKYO) (SCIENCE)
KAGAKU ASAHI (SCIENTIFIC ASAHI)
KAGAKU KEISATSU KENKYUSHO HOKOKU
(REP NAT RES INST POLICE SCI)
KAGAKU KOGYO (CHEM IND (TOKYO))
KAGAKU NO RYOIKI (J JAP CHEM)
KAGAKU TO KOGYO (TOKYO) (CHEM
CHEM IND)
KAGAKU TO SEIBUTSU (CHEM BIOL)
KAGAWA-KEN NOGYO SHIKENJO KENKYU
HOKOKU (BULL KAGAWA PREFECT AGR
EXP STA)
KANAGAWA-KEN EISEI KENKYUSHO NENPO
(ANNU REP KANAGAWA PREFECT PUB
HEALTH LAB)
KANKYO HAKAI (ENVIRON DESTRUCT)
KANTO TOSAN BYOGAICHU KENKYUKAI
NENPO (PROC KANTO TOSAN PLANT
PROTECT SOC)
KEM IND
KERTESZETIEGYETEM KOZLEM
KHARCHOVA PROM
KHIG ZDRAVEOPAZVANE
KHIM IND (SOFIA)
KHIM SEL KHOZ
KIEL MILCHWIRT FORSCHUNGSBER
KLIN MED (MOSCOW)
KLIN OCZNA
KLIN WOCHENSCHR
KOGAI TO TAISAKU (J PUB NUISANCE)
KOGYO YOSUI (IND WATER)
KONGETSU NO NOYAKU (AGR CHEM MON)
KONSERV OVOSHCHESUSH PROM
KOSHU EISEIIN KENKYU HOKOKU (BULL
INST PUB HEALTH)
KOSMOS (STOCKHOLM)
KOSMOS (WARSAW) SER A
KUEHN-ARCH
KUMAMOTO-KEN EISEI KENKYU SHOHO
(ANNU REP KUMAMOTO PREFECT INST
PUB HEALTH)
KURUME IGAKKAI ZASSHI (J KURUME
MED ASS)
LA AGR
LAB ANIM
LAB DELO
LAB INVEST
LAB MED
LAB PRACT
LAEDEV PART B
LAEKARTIDNINGEN
LAIT
LANCET
LANDBOUWK TIJDSCHR
LANDTECHNIK
LANTBRUKSHOEGSK MEDD SER A
LATV PSR ZINAT AKAD VESTIS
LAV UM
LEK OBZ
LIFE SCI PART I
LIFE SCI PART II
LIFIDS
MAATALOUSTIETEELLINEN AIKAK
MAGY ALLATORV LAPJA
MALAYSIAN AGR J
MANITOBA ENTOMOL
MAR BIOL
MAR POLLUT BULL
MASS AGR EXP STA RES BULL
MED ANN D C
MED BIOL SEE IGAKU TO SEIBUTSUGAKU
MED BIOL ENG
MED BULL
MED CLIN N AMER
MED COUNTERPOINT
MED ESPAN
MED GLAS
MED J AUST
MED J COMMUN WORKERS SEE TEISHIN
GAKU
MED KLIN (MUNICH)
MED LAV
MED MONATSSCHR
MED PARAZITOL PARAZIT BOLEZ
MED PRACY
MED SCI LAW
MED SEGUR TRAB
MED TIMES (PORT WASH N Y)
MED TREAT SEE IRYO
MED TRIAL TECH QUART
MED WELT
MED WET
MED WIEJSK
MED WORLD NEWS
MED ZH UZB
MEDED FAC LANDBOUWWETENSCH
RIJKSUNIV GENT
MEDICAMENTA
MEDICINA (BUENOS AIRES)
MELD NORG LANDBRUKSHOEGSK
METALS MINER REV
MFG CHEM AEROSOL NEWS
MICH ACAD
MICROBIOL ESPAN
MICROCHEM J
MIE-KEN EISEI KENKYUSHO NENPO (ANNU
REP MIE PREFECT INST PUB HEALTH)
MIKROBIOL ZH (KIEV)
MIKROCHIM ACTA
MILCHWISSENSCHAFT
MINERVA ANESTESIOL
MINERVA MED
MINING ENG (N Y)
MINN MED
MINN UNIV AGR EXT SERV BULL
MISS FARM RES
MITT BIOL BUNDESANST LAND-FORSTWIRT
BERLIN-DAHLEM
MITT CHEM FORSCHUNGSINST WIRT
OESTERR OESTERR KUNSTSTOFFINST
MITT GEB LEBENSMITTELUNTERS HYG
MITTEILUNGSBL GDCH (GES DEUT CHEM)
FACHGRUPPE LEBENSMITTELCHEM
GERICHTL CHEM
MIZU SHORI GIJUTSU (WATER TREAT
TECHNOL)
MLJEKARSTVO
MO MED
MOD MED (CHICAGO)
MOD PACKAG
MOD VET PRACT
MOL PHARMACOL
MOLOCH PROM
MONATSH VETERINAERMED
MOSQUITO NEWS
MUENCHEN BEITR ABWASSER-FISCH-
FLUSSBIOL
MUENCHEN MED WOCHENSCHR
MUTAT RES
MYCOPATHOL MYCOL APPL
N DAK FARM RES
N ENGL J MED
N ENGL MAR RESOUR INFORM
N J AGR EXP STA BULL
N Y FISH GAME J
N Y STATE ASS MILK FOOD SANIT ANNU REP
N Z J AGR
N Z J AGR RES
N Z J EXP AGR
N Z J MAR FRESHWATER RES
N Z J SCI
N Z MED J
N Z VET J
NACHRICHTENBL DEUT PFLANZENSCHUTZDIENSTES
NACHRICHTENBL PFLANZENSCHUTZDIENST DDR
NAGASAKI-KEN EISEI KENKYU NENPO
(ANNU REP NAGASAKI PREFECT HYG LAB)
NAGOYA-SHI EISEI KENKYU SHOHO
(REP NAGOYA MUNIC PUB HEALTH LAB)
NAHRUNG
NAIKA (INTERN MED)
NARA IGAKU ZASSHI (J NARA MED ASS)
NARA-KEN EISEI KENKYU SHOHO (ANNU
REP NARA PREFECT INST PUB HEALTH)
NASA TECH TRANSL
NAT FISHERMAN
NAT PEST CONTR OPER NEWS
NAT WOOL GROWER
NATUR HIST
NATURE (LONDON)
NATURE (LONDON) NEW BIOL
NATURWISS RUNDSCH

NATURWISSENSCHAFTEN
NAUCH TR VISSH PEDAGOG INST PLOVDIV MAT FIZ KHIM BIOL
NAUNYN-SCHMIEDEBERGS ARCH PHARMAKOL
NEB EXP STA QUART
NED TIJDSCHR GENEESKD
NEHEZVEGYIP KUT INTEZ KOZLEM
NEMATOLOGICA
NEPEGESZSEGUGY
NETH J AGR SCI
NETH J PLANT PATHOL
NETH J ZOOL
NEUROL NEUROCHIR POL
NEUROL PSIHIAT NEUROCHIR
NEUROLOGY
NEUROPATOL POL
NEUROPHARMACOLOGY
NEW SCI
NEWSLETT ENVIRON MUTAGEN SOC
NICHIDAI IGAKU ZASSHI (NIPPON UNIV MED J)
NIPPON CHIKUSAN GAKKAI-HO (JAP J ZOOTECH SCI)
NIPPON DOJO-HIRYOGAKU ZASSHI (J SCI SOIL ANIM FERT JAP)
NIPPON EISEIGAKU ZASSHI (JAP J HYG)
NIPPON GANKA GAKKAI ZASSHI (J JAP OPHTHALMOL SOC)
NIPPON GANKA KIYO (J JAP OPHTHALMOL)
NIPPON GANGAKKAI KIJI (PROC JAP CANCER ASS)
NIPPON HOIGAKU ZASSHI (JAP J LEG MED)
NIPPON HOSHASEI DOIGENSO KYOKAI NYUSU (JAP RADIOISOTOPE ASS NEWS)
NIPPON IJI SHINPO (JAP MED J)
NIPPON ISHIKAI ZASSHI (J JAP MED ASS)
NIPPON JUIGAKU ZASSHI (JAP J VET SCI)
NIPPON KINGAKKAI KAIHO (TRANS MYCOL SOC JAP)
NIPPON KOGYO EISEI GAKKAI NENKAI HOKOKU (PROC JAP IND HYG SOC ANNU MEET)
NIPPON KOSHU EISEI ZASSHI (JAP J PUB HEALTH)
NIPPON KYOBU-GEKA GAKKAI ZASSHI (J JAP ASS THORAC SURG)
NIPPON KYOBU SHIKKAN GAKKAI ZASSHI (JAP J THORAC DIS)
NIPPON NOGEI KAGAKU KAISHI (J AGR CHEM SOC JAP)
NIPPON NOSON IGAKKAI ZASSHI (J JAP ASS RURAL MED)
NIPPON OYO DOBUTSU KONCHU GAKKAI-SHI (JAP J APPL ENTOMOL ZOOL)
NIPPON RINSHO (JAP CLIN MED)
NIPPON RINSHO DENSHI KENBIKYO GAKKAI-SHI (J JAP ELECTRON MICROSC SOC)
NIPPON SAIGAI IGAKKAI KAISHI (J JAP ACCIDENT MED ASS)
NIPPON SANGYO EISEI GAKKAI KOENSHU (PROC JAP IND HYG SOC ANNU MEET)
NIPPON SHOKUHIN KOGYO GAKKAI-SHI (J FOOD SCI TECHNOL)
NIPPON SUISAN GAKKAI-SHI (BULL JAP SOC SCI FISH)
NIPPON UNIV MED J SEE NICHIDAI IGAKU ZASSHI
NO TO SHINKEI (BRAIN NERVE)
NOGYO GIJUTSU (J AGR SCI)
NOGYO OYOBI ENGEI (AGR HORT)
NOHA TO KINDENZU (ELECTROENCEPHALOGR ELECTROMYOGR)
NOR SKOGIND
NOR VET-TIDSSKR
NORD HYG TIDSKR
NORD MED
NORD VET MED
NORTHWEST MED
NOTIZ MAL PIANTE
NOUV PRESSE MED
NOYAKU BIJINESU (PESTIC BUSINESS)
NOYAKU KAGAKU (J PESTIC SCI)
NOYAKU KENSASHO HOKOKU SEE BULL AGR CHEM INSP STA
NOYAKU SEISAN GIJUTSU (PESTIC TECH)
NUOVI ANN IG MICROBIOL
NURS TIMES
NUTR REP INT
NUTR REV
OBSTET GYNECOL
OCROTIREA NATUR
OEFF GESUNDHEITSW
OFTAL'MOL ZH
OHIO AGR RES DEVELOP CENT RES CIRC
OHIO J SCI
OIKOS
OKAYAMA IGAKKAI ZASSHI (J OKAYAMA MED SOC)
OKAYAMA-KEN EISEI KENKYUSHO NENPO (ANNU REP OKAYAMA PREFECT PUB HEALTH LAB)
OLEAGINEUX
ONDERSTEPOORT J VET RES
ONKOLOGIYA (KIEV)
OPHTHALMOLOGY SEE GANKA
ORG CHEM SOIL ENVIRON
ORG MAGN RESONANCE
ORG MASS SPECTROM
ORNITHOL BEOB
ORV HETIL
OSAKA SHIRITSU DAIGAKU IGAKU ZASSHI (J OSAKA CITY MED CENT)
OSAKA SHIRITSU EISEI KENKYUSHO KENKYU HOKOKU (REP OSAKA MUNIC INST PUB HEALTH)
OUTLOOK AGR
OYO-YAKURI (PHARMACOMETRICS)
PA MED
PAEDIAT INDONES JAKARTA
PAK J SCI IND RES
PAK J SCI RES
PAMIET PULAWSKI
PAP PROCESS
PAP PUU
PARFUMS COSMET SAVONS
PATHOL BIOL
PATOL POL
PEDIAT CLIN N AMER
PEDIAT POL
PEDIATRICS
PEDIATRICS (TOKYO) SEE SHONIKA
PEDIATRIYA (MOSCOW)
PEDOBIOLOGIA
PEDOLOGIE
PEST CONTR
PESTIC BIOCHEM PHYSIOL
PESTIC BUSINESS SEE NOYAKU BIJINESU
PESTIC MONIT J
PESTIC PEST
PESTIC SCI
PESTIC TECH SEE NOYAKU SEISAN GIJUTSU
PESTICIDES
PFLANZENARZT
PFLANZENSCHUTZ-NACHR
PFLUEGERS ARCH
PHARM MON SEE GEKKAN YAKUJI
PHARM UNSERER ZEIT
PHARM WEEKBL
PHARMACOL RES COMMUN
PHARMACOLOGIST
PHARMACOLOGY
PHARMACOMETRICS SEE OYO YAKURI
PHARMACY SEE FARMUASHIA
PHARMAZIE
PHYSIOL BEHAV
PHYSIOL BOHEMOSLOV
PHYSIOL PLANT
PHYTIAT-PHYTOPHARM
PHYTOCHEMISTRY
PHYTOMA
PHYTOPATHOL Z
PHYTOPATHOLOGY
PHYTOPHYLACTICA
PHYTOPROTECTION
PLANT BULL
PLANT PHYSIOL
PLANT PROTECT SEE SHOKUBUTSU BOEKI
PLANT SOIL
PLANTA MED
POCHVOVED AGROKHIM
POCHVOVIDENIE
POL ARCH HYDROBIOL
POL ARCH WET
POL PHARMACOL PHARM
POL PISMO ENTOMOL
POL TYG LEK
POL'NOHOSPODARSTVO
POSTEPY HIG MED DOSW
POSTEPY MIKROBIOL
POSTEPY NAUK ROLN
POSTGRAD MED
POSTGRAD MED J
POTATO RES
POULTRY SCI
PPM
PR CENT INST OCHR PR
PR INST LAB BADAW PRZEM SPOZYW
PR INST PRZEM ORG
PRAC LEK
PRAKT SCHAEDLINGSBEKAEMPF
PRAKT TIERARZT
PRAXIS
PRENSA MED ARGENT
PRESSE MED
PRESSE THERM CLIM
PRIRODA (MOSCOW)
PROBL ANAL KHIM
PROBL ENDOKRINOL
PROC AGR PRACT WATER QUAL
PROC AMER ASS CANCER RES
PROC ANNU CALIF WEED CONF
PROC ANNU CONF SOUTHEAST ASS GAME FISH COMM
PROC ANNU MEET N J MOSQ EXTERM ASS
PROC ANNU TALL TIMBERS FIRE ECOL CONF
PROC ARKANSAS ACAD SCI
PROC ASS INT LIMNOL THEOR
PROC BIODETERIOR MATER
PROC BRIT PEST CONTR CONF
PROC BRIT WEED CONTR CONF 10TH
PROC CAN FED BIOL SOC
PROC CONF GT LAKES RES
PROC ENTOMOL SOC ONT
PROC 1ST EUR BIOPHYS CONGR
PROC GULF COAST CONF MOSQ
PROC HAWAII ENTOMOL SOC 1970
PROC INDIANA ACAD SCI
PROC INST ENVIRON SCI ANNU TECH MEET
PROC INT CONF ADVAN WATER POLLUT
PROC INT CONG RURAL MED
PROC IOWA ACAD SCI
PROC JAP CANCER ASS SEE NIPPON GANGAKKAI KIJI
PROC JAP IND HYG SOC ANNU MEET SEE NIPPON KOGYO EISEI GAKKAI NENKAI HOKOKU
PROC JAP IND HYG SOC ANNU MEETING SEE NIPPON SANGYO EISEI GAKKAI KOENSHU
PROC KANTO TOSAN PLANT PROTECT SOC SEE KANTO TOSAN BYOGAICHU KENKYUKAI NENPO
PROC MEAT IND RES CONF
PROC N CENT WEED CONTR CONF
PROC N DAK ACAD SCI
PROC N Z WEED PEST CONTR CONF
PROC NAT ACAD SCI USA
PROC NAT CONF PROT CLOTHING SAF EQUIP PESTIC WORK
PROC NAT SHELLFISH ASS
PROC NORTHEAST WEED SCI SOC

PROC NUTR SOC
PROC PA ACAD SCI
PROC QUEENSL SOC SUGAR CANE TECHNOL
PROC ROY AUST CHEM INST
PROC ROY SOC EDINBURGH B
PROC ROY SOC LONDON
PROC ROY SOC MED
PROC S WEED SCI SOC
PROC SEMIN ENVIRON ECOL PESTIC
PROC SOC ANAL CHEM
PROC SOC EXP BIOL MED
PROC SOC PLANT PROTECT HOKURIKU
  SEE HOKORIKU BYOGAICHU KENKYU KAIHO
PROC UNIV OTAGO MED SCH
PROC UTAH MOSQ ABATEMENT ASS
PROC WASH STATE ENTOMOL SOC
PROC WEST PHARMACOL SOC
PROC WEST SOC WEED SCI
PROCESS CHEM ENG
PROD PROBL PHARM
PROGR AGR ARIZONA
PROGR BIOCHEM PHARMACOL
PROGR BRAIN RES
PROGR CHEM CHEM IND SEE HWAHAK KWA
  KONGOP UI CHINBO
PROGR CHEM FATS OTHER LIPIDS
PROGR EXP TUMOR RES
PROGR FISH CULTURIST
PROGR MED SEE IGAKU NO AYUMI
PROGR MED CHEM
PROM ARM
PROTECT VITAE
PROTOPLASMA
PRUM POTRAVIN
PRZEGL EPIDEMIOL
PRZEM SPOZYW
PSYCHIAT POL
PSYCHOPHARMACOLOGIA
PSZCZELNICZE ZESZ NAUK
PUB HEALTH
PUF HEALTH LAB
PURDUE UNIV AGR EXP STA RES BULL
PYRETHRUM POST
QUAD SCLAVO DIAGN CLIN LAB
QUAL PLANT MATER VEG
QUART J FOREST
QUART MED REV
QUEENSL AGR J
QUEENSL J AGR ANIM SCI
RADIOCHEM RADIOANAL LETT
RADIOLOGY
RALATA TECH CHIM BIOL APPL
RASS CHIM
REC MED VET ECOLE ALFORT
RECHERCHE
RECL MED VET
REFUAH VET
REP AKITA PREFECT INST PUB HEALTH
  SEE AKITA-KEN EISEI KAGAKU KENKYU
  SHOHO
REP GOVT CHEMIST 1970
REP HOKKAIDO INST PUB HEALTH SEE
  HOKKAIDORITSU EISEI KENKYU SHOHO
REP NAGOYA MUNIC PUB HEALTH LAB
  SEE NAGOYA-SHI EISEI KENKYU SHOHO
REP NAT INST POLICE SCI SEE KAGAKU
  KEISATSU KENKYUSHO HOKOKU
REP OSAKA MUNIC INST PUB HEALTH
  SEE OSAKA SHIRITSU EISEI KENKYUSHO
  KENKYU HOKOKU
REP SAGA PREFECT INST PUB HEALTH
  SEE SAGA-KEN EISEI KENKYUSHO
REP TOTTORI PREFECT HYG RES INST
  SEE TOTTORI-KEN EISEI KENKYUSHO-HO
RES COMMUN CHEM PATHOL PHARMACOL
RES IND
RES VET SCI
RESIDUE REV
RESUSCITATION
REV AGROQUIM TECNOL ALIMENT
REV APPL ENTOMOL (B)
REV ASOC BIOQUIM ARGENT
REV BIOL (LISBON)
REV BRASIL FARM
REV CHIL PEDIAT
REV CHIM (BUCHAREST)
REV COLOMB CIENC QUIM
REV ECOL BIOL SOL
REV FAC AGRON UNIV NAC PLATA
REV FAC CIENC AGR UNIV NAC CUYO
REV FAC FARM ODONTOL ARARAQUARA
REV FARM BIOQUIM UNIV SAO PAULO
REV INST ADOLFO LUTZ
REV INT CHOC
REV LAIT FR
REV LYON MED
REV MED (TIRGU-MURES)
REV MED MEX
REV MED CHILE
REV MED-CHIR
REV MED VET (TOULOUSE)
REV PADURILOR
REV PERU ENTOMOL
REV ROUM BIOCHIM
REV ROUM NEUROL
REV SANID HIG PUB
REV ZOOTEH MED VET
RICE J
RINGYO SHIKENJO KENKYU HOKOKU (BULL
  GOV FOREST EXP STA)
RINGYO TO YAKUZAI (FOREST PHARM)
RINSHO BYORI (JAP J CLIN PATHOL)
RINSHO EIYO (J CLIN NUTR)
RINSHO GANKA (CLIN OPHTHALMOL)
RINSHO NOHA (CLIN ELECTROENCEPHAL)
RIV INFORT MAL PROF
RIV ITAL SOSTANZE GRASSE
RIV NEUROL
RIV VITICOLT ENOL
ROCKY MT MED J
ROCZ CHEM
ROCZ GLEBOZN
ROCZ PANSTW ZAKL HIG
ROCZ POMORSKIEJ AKAD MED SZCZECINIE
RODO EISEI (JAP J IND HYG)
ROM MED REV
ROY SOC HEALTH J
RUSS PHARMACOL TOXICOL
  TRANS OF FARMAKOL TOXICOL (MOSCOW)
RYB KHOZ
S AFR CHEM PROCESS
S AFR J LAB CLIN MED
S AFR MED J
S AFR SUGAR J
S OAK BIRD NOTES
S OAK HOME RES
SAGA-KEN EISEI KENKYUSHO (REP SAGA
  PREFECT INST PUB HEALTH)
SAIBOKAKU BYORIGAKU ZASSHI (ARCH
  HISTOL)
SANGYO IGAKU (IND MED)
SANKYO KENKYUSHO NENPO (ANNU REP
  SANKYO RES LAB)
SB NAUCH TR DONSKOI SEL'SKOKHOZ INST
SB KAB LENINGRAD VET INST
SB TR SUD MED SUD KHIM MATER SOVESHCH
SB VED PR LEK FAK KARLOVY UNIV HRADCI
  KRALOVE
SB VED PR VYZ SK CHEMICKOTECHNOL
  PARDUBICE
SB VYS SK CHEM-TECHNOL PRAZE CHEM
  TECHNOL SILIKATU
SCAND J RESP DIS
SCHRIFTENR VER WASSER-BODEN-LUFTHYG
  BERLIN-DAHLEM
SCHWEIZ ARCH TIERHEILK
SCHWEIZ Z MILITAERMED
SCI AGR BOHEMOSLOV
SCI ALIMENT
SCI ASAHI SEE KAGAKU ASAHI
SCI FOODS SEE SHOKURYO NO KAGAKU
SCI HORT
SCI NEWS
SCI PEST CONTR SEE BOCHU KAGAKU
SCI PROGR DECOUVERTE
SCI REP HIROSAKI UNIV
SCI TOOLS
SCI TOTAL ENVIRON
SCIENCE
SCIENCE (TOKYO) SEE KAGAKU (TOKYO)
SCIENCES
SCOT MED J
SEARCH
SEIBUTSU KAGAKU (BIOL SCI)
SEIKAGAKU (J JAP BIOCHEM SOC)
SEL'SKOKHOZ BIOL
SEM HOP
SEM MED
SEM THER
SENTEN IJO (CONGENITAL ANOMALIES)
SHIKOKU KOSHU EISEIGAKU ZASSHI (J
  SHIKOKU PUB HEALTH SOC)
SHIMADZU HYORON (SHIMADZU REV)
SHIMADZU REV SEE SHIMADZU HYORON
SHIMANE-KEN EISEI KENKYUSHO NENPO
  (ANNU REP SHIMANE PREFECT INST
  PUB HEALTH)
SHINKEI KENKYU NO SHIMPO (ADVAN
  NEUROL SCI)
SHINRYO TO HOKEN (CLIN MED)
SHOKUBUTSU BOEKI (PLANT PROTECT)
SHOKUHIN EISEIGAKU ZASSHI (J FOOD
  HYG SOC JAP)
SHOKURYO NO KAGAKU (SCI FOODS)
SHONIKA (PEDIATRICS (TOKYO))
SHOYAKUGAKU ZASSHI (J PHARMACOGNOSY)
SINGAPORE MED J
SOAP COSMET CHEM SPEC
SOC APPL BACTERIOL SYMP SER
SOGO RINSHO (CLIN ALL-AROUND)
SOIL BIOCHEM
SOIL BIOL BIOCHEM
SOIL SCI
SOIL SCI SOC AMER PROC
SOOBSHCH AKAD NAUK GRUZ SSR
SOUTH MED J
SOV GENET (TRANS OF GENETIKA)
SOV MED
SOV ZDRAVOOKHR KIRG
SPAN (LONDON)
SPECTROSC LETT
SRP ARH CELOK LEK
STAEDTEHYGIENE
STAUB
STEROIDOLOGIA
STEROIDS
STOMATOLOGIYA (MOSCOW)
STOMATOLOGIYA (SOFIA)
STRAHLENTHERAPIE
STUD BIOPHYS
STUD CERCET CHIM
STUD GEN
SUCCESSFUL FARMING
SUCR BELGE
SUD-MED EKSPERT
SUESSWAREN
SUNDHEDSSTYRELSEN
SUVREM MED
SV FARM TIDSKR
SVER UTSAEDESFOEREN TIDSKR
SYMP BIOL HUNG
TAIKI OSEN KENKYU (J JAP SOC AIR
  POLLUT)
TAI-WAN I HSUEH HUI TSA CHIH
  SEE J FORMOSAN MED ASS
TAIWANIA
TAKEDA KENKYUSHO HO (J TAKEDA RES LAB)
TALANTA
TAXON
TECH LAIT

TECH SCI
TECH SCI MUNIC
TECHNOL REV
TEISHIN GAKU (MED J COMMUN WORKERS)
TEK TIDSKR
TENN FARM HOME SCI PROGR REP
TER ARKH
TERATOLOGY
TERRE VIE (PARIS)
TETHYS
TETRAHEDRON
TETRAHEDRON LETT
TEX AGR EXP STA BULL
TEX AGR EXP STA PROGR REP
TEX J SCI
TEX LAW REV
TEX WATER DEVELOP BD REP
THEOR APPL GENET
THER GEGENW
THERAPIE
THERAPIEWOCHE
THORAX
TIDSSKR KJEMI BERGV MET
TIDSSKR NOR LAEGEFOREN
TIDSSKR PLANTEAVL
TIERAERZTL UMSCH
TIJDSCHR DIERGENEESK
TIJDSCHR SOC GENEESK
TLUSZCZE JADALNE
TNO NIEUWS
TOB HEALTH WORKSHOP CONF PROC
TOB INT SEE TOB SCI
TOB SCI
TOHO IGAKKAI ZASSHI (J MED SOC TOHO UNIV)
TOHOKU J EXP MED
TOKYO-TORITSU EISEI KENKYUSHO KENKYU NENPO (ANNU REP TOKYO METROP RES LAB PUB HEALTH)
TOTTORI-KEN EISEI KENKYUSHO-HO (REP TOTTORI PREFECT HYG RES INST)
TOXICOL APPL PHARMACOL
TOXICOLOGY
TOXICON
TR KAZ NAUCH-ISSLED VET INST
TR MOLD NAUCH-ISSLED INST ZHIVOTNOVOD VET
TR UZB NAUCH-ISSLED INST VET
TRANS AMER FISH SOC
TRANS ASAE (AMER SOC AGR ENG)
TRANS ILL STATE ACAD SCI REP
TRANS MYCOL SOC JAP SEE NIPPON KINGAKKAI KAIHO
TRANS ROY SOC TROP MED HYG
TRANS SOC OCCUP MED
TRAV SOC PHAR MONTPELLIER
TROP GEOGR MED
TROP STORED PROD INFORM
TSITOL GENET
TSITOLOGIYA
TUMORI
UCH ZAP KAZAN VET INST
UCH ZAP PETROZAVODSK GOS UNIV
UGESKR LAEGER
UKR BIOKHIM ZH
UMSCHAU
UNESCO COUR
UNIV WASH PUBL FISH NEW SER
UZB BIOL ZH
UZB KHIM ZH
VA J SCI
VA MED MON
VAEXTSKYDDSNOTISER
VAR FOEDA
VERH DEUT GES INN MED
VERH KON VLAAM ACAD GENEESK BELG
VERN OG VELFERD
VEROEFF INST MEERESFORSCH BREMERHAVEN
VESTN AKAD MED NAUK SSSR
VESTN DERMATOL VENEROL
VESTN OTORINOLARINGOL
VESTN SEL'SKOKHOZ NAUKI (MOSCOW)
VESTN ZOOL
VESTSI AKAD NAVUK BELARUS SER SEL'SKAGASPAD NAVUK
VET ARH
VET CAS
VET CLIN N AMER
VET GLASN
VET ITAL
VET MED
VET-MED NAUKI
VET MED SMALL ANIM CLIN
VET REC
VET SBIRKA
VETERINARIA (SARAJEVO)
VETERINARIYA (MOSCOW)
VIRCHOWS ARCH A
VIRCHOWS ARCH B
VISION RES
VOD HOSPOD B
VOEDING
VOEDINGSMIDDELENTECHNOLOGIE
VOENNO-MED ZH
VOJNOSANIT PREGL
VOM WASSER
VOP MED KHIM
VOP OKHR MATERIN DETSTVA
VOP ONKOL
VOP PITAN
VRACH DELO
VYZIVA ZDRAVIE
WAKAYAMA-KEN EISEI KENKYUSHO NENPO (ANNU REP WAKAYAMA PREFECT INST PUB HEALTH)
WALLACE'S FARMER
WASH AGR EXP STA CIRC
WASSER BODEN
WASSERWIRT-WASSERTECH
WATER AIR SOIL POLLUT
WATER POLLUT CONTR
WATER RES
WATER RESOUR RES
WATER SEWAGE WORKS
WATER TREAT TECHNOL SEE MIZU SHORI GIJUTSU
WATER WASTE SEE YOSUI TO HAISUI
WATER WASTES ENG
WEED CONTR SEE ZASSO TO SONO BOJO
WEED RES
WEED RES (TOKYO) SEE ZASSO KENKYU
WEED SCI
WEST INDIAN MED J
WETENSCH GENET
WHO CHRONICLE
WIAD CHEM
WIAD LEK
WIAD PARAZYTOL
WIEN KLIN WOCHENSCHR
WIEN TIERAERZTL MONATSSCHR
WILSON BULL
WIS DEP AGR BULL
WISS BEITR MARTIN-LUTHER UNIV HALLE-WITTENBERG
WORK ENVIRON HEALTH
WORLD AGR
WORLD FARMING
WORLD HEALTH ORGAN TECH REP SER
WORLD MED J
WORLD REV PEST CONTR
XENOBIOTICA
YAKUGAKU ZASSHI (J PHARM SOC JAP)
YAMAGUCHI-KEN EISEI KENKYUSHO KENPO (ANNU REP YAMAGUCHI PREFECT RES INST HEALTH)
YAMAGUCHI SANGYO IGAKU (ANNU REP YAMAGUCHI SOC IND HEALTH)
YAMANASHI KENRITSU EISEI KENKYUSHO NENPO (ANNU REP YAMANASHI PREFECT INST PUB HEALTH)
YOSUI TO HAISUI (WATER WASTE)
YOUR ENVIRON
YUKAGAKU (J JAP OIL CHEM SOC)
Z AERZTL FORTBILD
Z ALLGEMEINMED
Z ANGEW ENTOMOL
Z ANGEW ZOOL
Z CHEM
Z GESAMTE HYG
Z KLIN CHEM KLIN BIOCHEM
Z KULTURTECH FLURBEREINIG
Z LEBENSM-UNTERS-FORSCH
Z NATURFORSCH
Z NEUROL
Z PFLANZENKR PFLANZENSCHUTZ
Z RECHTSMED
Z WASSER ABWASSER FORSCH
ZAP LENINGRAD SEL'SKOKHOZ INST
ZASHCH RAST (KIEV)
ZASHCH RAST (MOSCOW)
ZASSO KENKYU (WEED RES (TOKYO))
ZASSO TO SONO BOJO (WEED CONTR)
ZAST BILJA
ZAST MATER
ZAVOD LAB
ZDRAVOOKHR KAZ
ZDRAVOOKHR TURKM
ZDRAVOOKHRANENIE
ZENTRALBL ALLG PATHOL PATHOL ANAT
ZENTRALBL BAKTERIOL PARASITENK INFEKTIONSKR
ZENTRALBL BAKTERIOL PARASITENK INFEKTIONSKR HYG ABT 1
ZENTRALBL VETERINAERMED REIHE A
ZESZ NAUK WYZSZ SZK ROLN OLSZTYNIE
ZH ANAL KHIM
ZH MIKROBIOL EPIDEMIOL IMMUNOBIOL
ZH NEVROPATOL PSIKHIAT IM S S KORSAKOVA
ZH PRIKL KHIM (LENINGRAD)
ZH USHN NOS GORL BOLEZ
ZHIVOTNOVODSTVO
ZOOPROFILASSI
ZUCKER

74-0001. Edwards, J. G. (Dept. Entomol., California State Univ., San Jose, CA). **Dichlorodiphenyl trichloroethane. (Should DDT be banned or praised?)** *Amer. Inst. Chem. Eng. Symp. Ser. 69(129): 293-297; 1973.*

According to the author, the campaign for banning DDT in the U.S. lacks objectivity, credibility, and scientific ethics. In addition, it disregards the testimony of most medical, agricultural, entomological, and public health experts that DDT is degraded by chemical, thermal, and biological means. Adverse effects have not been found in persons occupationally exposed to DDT. Allegations that DDT has been detrimental to wildlife are based on association rather than scientific proof. Laboratory experiments designed to demonstrate a toxic effect have used unrealistically high levels. A total ban on DDT could be genocidal since many countries do not have alternatives for control of vector-borne diseases and protection of crops; a ban in the U.S. could frighten underdeveloped countries into terminating their public health uses of DDT.

74-0002. Adrian, H. F. (Ind. Hyg. Program, Div. of Occup. Health and Radiation Control, Texas State Dept. of Health, Austin, TX 78756). **Use of pest control chemicals in Texas.** *Amer. Ind. Hyg. Ass. J. 34(7): 320-327; 1973.* (18 references)

The author reviews the impact on the economy of the State from the use of certain chemical elements and compounds for the abatement and control of vectors that compete with man for his needs of food and fiber. The size, topography, and climate of Texas offer many favorable ecological niches for the maintenance and transmission of arthropod-borne diseases of man and animals. A review is given of epidemics caused by arthropod-borne agents and their near-eradication or control by the judicious use of insecticides. The possible consequences of eliminating the use of pesticides and nitrogen fertilizers on the output of food and fiber crops are discussed. Unrealistic restrictions on use of insecticides would be equally devastating in public health vector control programs. Current legislation for the use and sale of pesticidal chemicals in Texas is discussed, and the needs for further regulation in the State are cited. Recognition is given to the need for a continuing evaluation of the interrelationship between human health, food production, protection of wildlife resources, and the preservation of environmental quality. (Author abstract by permission)

74-0003. Hartung, R.; Dinman, B. D. (Inst. Environ. Ind. Health, Univ. Michigan, Ann Arbor, MI). **Environmental mercury contamination.** *Ann Arbor Science Publishers Inc., Ann Arbor, 1972, 349 p.* (796 references)

The material in this work is based on papers presented at the International Conference on Environmental Mercury Contamination at Ann Arbor, Michigan, Sept. 30-Oct. 2, 1970. The conference was convened to assess the current status of knowledge and research needs on the problems of mercury contamination. Papers are included in four subject areas: occurrence of mercury in the environment and man, methods of analysis, environmental dynamics of mercury, and biological effects of mercury compounds. Papers of pesticidal pertinency include those relating to sources of mercury in the environment; organic mercury poisoning in Alamogordo, New Mexico; survival and reproduction of ring-necked pheasants consuming two mercurial fungicides; and dose-response relationships after exposure of swine to organomercurial compounds.

74-0004. Kramer, W.; Sass, O.; Bech, R. (Forschungsbereich Biol. Anwendungstechn. Pflanzenschutzm., VEB Chemiekombinat Bitterfeld, Germany). **Zur Entwicklung und Anwendung von Pflanzenschutz- und Schaedlingsbekaempfungsmitteln unter Beachtung der Belange des Umweltschutzes. [Development and use of pesticides, allowing for the requirements of environmental protection.]** *Chem. Tech. (Leipzig) 25(7): 420-422; 1973.* (6 references) (German)

Minimizing the dangers and risks of pesticides is as essential to the environment as the chemicals are to modern agriculture. As new pesticides appear to replace those being phased out like DDT, extensive testing is required to ensure environmental safety: 6-8 years of testing must elapse before a product can be marketed. Toxicologic testing encompasses known or presumed metabolites of the pesticide. Test results aid in minimizing danger to the environment and are used during registration application and for establishing tolerances and waiting periods between application and harvest. Despite precautions, undesirable effects of pesticides may result from negligence, human error, improper use, and unfavorable environmental conditions. Small organisms such as bees, beneficial insects, and fish are more frequently affected by pesticide poisoning than are larger animals and birds. Application of organophosphates at excessive rates is commonly responsible for deaths of birds although losses of small birds are often recouped quickly.

74-0005. Copius Peereboom, J. W. (Author address not given). **Milieutoxicologie: is DDT dan toch carcinogeen? [Environmental toxicology: is DDT carcinogenic?]** *Chem. Weekbl. 69(19): 5,7; 1973.* (14 references) (Dutch)

Factors leading to the disparagement of DDT by environmentalists are reviewed; these include universal distribution, persistence, cumulative tendencies, placental transfer, possible carcinogenicity, possible mutagenicity, and effects on vital cellular processes. If carcinogenicity is proven, the Delaney Amendment would prohibit DDT use in the U.S. At least five reports were published between 1947 and 1972, indicating that DDT is carcinogenic. In 1967, a joint FAO/WHO project

involving participation of laboratories in several countries was established to study the carcinogenicity of DDT. Carcinogenic effects in the rat are being studied in the Leningrad Oncology Research Institute; BALB/c mice are being studied in Milan; and CFl mice are being studied in Lyon. Chemical analyses are being performed in London, Atlanta, and Jerusalem. Results on the effects of DDT on the first two generations of mice at Lyon were recently published by L. Tomatis (see abstract no. 73-0908). In the group fed DDT at 250 ppm in the diet liver tumor incidence was significantly elevated compared to the control group and resulted in increased mortality. A definite relationship was found between DDT dose and time of death from liver tumors as well as liver tumor incidence.

74-0006. Bouron, B. (Serv. Protect. Vegetaux, Paris, France). **La legislation des pesticides en agriculture. [Legislation on agricultural pesticides.]** *Econ. Med. Anim. 14(1): 33-41; 1973.* (French)

In France, pesticides are legally classified as chemical specialties and are governed by a number of laws and decrees. The homologation (official acceptance) law of Nov. 2, 1943, prohibits the distribution of any pesticide which has not been officially accepted; acceptance necessitates fulfilling the criteria of efficacy, absence of excessive danger to man and domestic animals, and lack of harm to treated crops. The manufacturer must submit an application for acceptance to the Plant Protection Office, along with data from four types of studies: physical, chemical, toxicologic, and biological. The list of accepted substances is periodically revised. The Decree of May 11, 1937, on the repression of fraud governs the labeling of various products, including pesticides, and covers the question of acceptable nomenclature. The Decree of November 26, 1956, on poisonous substances, falling under the Public Health Code, contains the regulations for use of poisonous substances, including the protective marking of poisons and other dangerous substances. The Law of Aug. 1, 1905, on the sale of food products, was taken as the basis for residue legislation, and various decrees have been added on establishment of residues. The ordinance of June 1, 1971, outlines the precautions to be taken during pesticide application to avoid environmental contamination.

74-0007. DeRijck, T. (Chief Inspector, Ministry of Public Health, Brussels, Belgium). **Wettelijke maatregelen ter voorkoming van de aanwezigheid van resten van bestrijdingsmiddelen in eetwaren. [Legal regulations governing the occurrence of pesticide residues in foods.]** *Ingenieursblad 41(20): 601-606; 1972.* (13 references) (Dutch)

In the Belgian Royal Proclamation of May 31, 1958, which dealt with the storage, sale, and use of pesticides, primary attention was given to the prevention of acute intoxications. Since that time, pesticide residues in foods have aroused worldwide anxiety, and the proclamation of Dec. 6, 1968, dealt with tolerances for pesticide residues in foods of vegetable origin. The tolerance levels in this law relate to the active ingredients as well as their breakdown products. Belgian law employs the single-tolerance system; i. e., only one value is named for all fruits and vegetables with the exception of potatoes. If separate tolerances for different classes or even individual species of fruit are adopted by the EEC, Belgian law may be modified in the future. The two principles governing the establishment of tolerances are that the resulting residue should be toxicologically acceptable and the tolerance compatible with good agricultural practice. Since 1968, the Institute for Hygiene and Epidemiology has analyzed about 1000 vegetable and fruit samples per year. The respective tolerances were exceeded in about 2% of the cases. The Codex Alimentarius Committee of WHO-FAO has developed a series of guidelines for attaining good agricultural practice with respect to pesticides.

74-0008. Onoe, T. **New Journal Announcement.** *Noyaku Kagaku (J. Pestic. Sci.) 1(1): 1; 1973.* (Japanese)

The journal title *Noyaku Seisan Gijutsu (Pesticides and Technique)* has been changed to *Noyaku Kagaku (Journal of Pesticide Science)* as of this issue. The content is not entirely new; it follows the general editorial policy of the former journal. The old journal emphasized the chemical technology behind the production of agricultural chemicals and published essays, reports, and information on research, development, and manufacturing of agricultural chemicals. In recent years criticism of agricultural chemicals and demands for scientific analysis of chemicals have greatly increased. The new journal will expand the scope of the old one and will try to answer these demands. According to the report on "Technical Development of Safe Agricultural Chemicals" published in March 1973 by the Agency of Scientific Technology of the Japanese Government, the future progress of agricultural chemical science will include the following eight goals: (1) development of rapidly-degrading non-residual pesticides; (2) development of synthetic pesticides with residues harmless to the human body and to useful animals and plants; (3) development of residue degradation accelerators; (4) development of microbiological pesticides; (5) the use of natural enemies to harmful insects; (6) synthesis and use of insect pheromones; (7) development of safe chemicals directly effective on plant viruses; (8) establishment of safety assurance methods for pesticides. Solving these urgent problems will require manpower, time, and money, but the progress and development of pesticide science is the most necessary foundation for the realization of these goals.

74-0009. Wright, N. (Ind. Hyg. Res. Lab., Imperial Chemical Industries, Ltd., Alderley Park, Macclesfield,

Cheshire, England). **The pattern of pesticide regulation in Western Europe.** *Outlook Agr. 7(3): 91-96; 1973.* (12 references)

Since pesticides are items of international trade and their residues occur on exported food and contaminate the total environment, legislation regulating these substances in various countries must be compatible. It is more difficult to achieve uniformity in industrialized countries, which have long-established laws, than in developing countries which can design legislation on the basis of experience elsewhere and advice from international agencies. Among the western European nations there are significant differences in attitude and methods of pesticide legislation. Except for the United Kingdom these countries prohibit the sale of any pesticide unless it has been registered for the specific uses included on the label, but the precise testing methods which are required in determining toxicity and the placement of emphasis on safe use or residues differ from country to country. Differences in label requirements, classification of pesticides by toxicity, and time interval between last spraying and harvest also exist. A number of international organizations, whose functions are listed, are presently working toward harmonization of pesticide regulation in various areas. Cooperation between government and industry, as observed in the United Kingdom, would be extremely valuable on a wider European or international front.

74-0010. Barnes, J. M. (Med. Res. Council Toxicol. Unit, MRC Lab., Woodmansterne Rd., Carshalton, Surrey, England). **Toxicology of agricultural chemicals.** *Outlook Agr. 7(3): 97-101; 1973.* (17 references)

International organizations and national governments have concentrated on establishing acceptable daily intakes on the basis of animal data although there is no evidence that pesticides in the small quantities normally encountered in food are harmful. Monitoring and prevention of poisonings resulting from occupational accidents, spillage of pesticides during transportation, or use of seed grains for food have been neglected. In California and the United Kingdom, where poisoning from pesticide exposure is monitored, only a few deaths have been reported. Although restrictions have been imposed on levels of pesticides in foods, governments have not limited use of the more toxic chemicals as less toxic substitutes become available.

74-0011. Marx, J. L. (Author address not given). **Insect control (II): hormones and viruses.** *Science 181(4102): 833-835; 1973.* (3 references)

Hormones and viruses being developed for insect control are expected to eventually reduce dependence on traditional insecticides and, consequently, the adverse effects of these chemicals on the environment. Juvenile hormones, used in special situations to prevent development of insect larvae to the adult stage, have the advantages of biodegradability and low mammalian toxicity; it is believed that resistance will develop more slowly than with standard insecticides. Viruses are already being used successfully for control of the cotton bollworm and are quite specific. The problem of producing the viruses without contamination may be solved by present efforts to develop cell culture systems.

74-0012. Wade, N. (Author address not given). **Insect viruses: a new class of pesticides.** *Science 181(4103): 925-928; 1973.*

The polyhedrosis virus of the cotton bollworm has been declared safe for use as a pesticide in a little-noticed announcement by the Environmental Protection Agency (EPA) in the *Federal Register*, Pending acceptance of efficacy data, this virus may become the first viral pesticide to be approved for use. Although formal review of this agent was not called for by the EPA, experts, including an international group who convened under the auspices of the WHO, were consulted on safety. A mass of evidence shows the viruses to be no health hazard, and the natural occurrence of such viruses on crops was a positive factor in the decision. An important theoretical hazard is that although the viruses attack only insect cells, the mechanism for this activity is unknown; the viruses could possibly change and be capable of attacking vertebrate cells. Contamination of the virus culture is another hazard, but this and other problems are minimized by the fact that human exposure would be oral or respiratory rather than by injection, the most dangerous form of exposure.

74-0013. Japanese Environmental Agency (Tokyo, Japan). **[Chapter IV, Section 6: Pesticide Pollution.]** *Showa 48-Nenban Kankyo Hakusho, Kankyo Hozen E No Atarashii Ruru (Environmental White Paper (1973): New Rules for the Protection of the Environment), pp. 272-276.* (Japanese)

The number of basic agricultural chemicals presently used in Japan is greater than 300 and includes more than 5000 registered formulations which are classified under organophosphate and organochlorine insecticides; organosulfur disinfectants; and other herbicides, pesticides, and plant growth regulators. The most hazardous to human health are the organochlorine pesticides, with β-BHC residues being most troublesome. However, other pesticides can cause damaging chronic toxicity when residues accumulate in the body over a period. No report has been made on residues in agricultural produce in recent years regarding dieldrin and DDT residues in the soil, and samples of cow's milk containing dangerous levels of β-BHC, dieldrin, or DDT have not been reported for some time. Between November 1971 and February 1972, all samples of mother's milk had β-BHC and DDT residues, and 70% had dieldrin residues;

however, concentrations were much lower compared to 1971 investigations. The residues in agricultural soil have gradually decreased. Since March of 1973 the use of arsenic, lead, endrin, dieldrin, aldrin, telodrin, endrin, benzoepin, PCP herbicides, and rotenone has been strictly regulated. The use of organomercury, DDT, TEPP, methylparathion, parathion, BHC, heptachlor, and 2,4,5-T has been prohibited.

74-0014. Bevenue, A.; Hylin, J. W.; Kelley, T. W. (Agr. Biochem., Univ. Hawaii, Honolulu, HI). **Organochlorine pollutants of the marine environments of Hawaii.** *Amer. Chem. Soc. Div. Water Air Waste Chem. Gen. Pap. 11(2): 101-105; 1971.* (3 references)

Ten samples of rainwater, 45 of drinking water, and 46 of non-potable water from the islands of Hawaii, Oahu, Kauai, and Maui were not significantly polluted by organochlorine pesticides. DDT, dieldrin, and lindane were most frequently observed with the highest value 64 ppt DDT; chlordane, TDE, and DDE were detected in some samples. Further studies will include samples suspected of potentially higher pesticide residues and will investigate seasonal variation and slick and strata variation.

74-0015. Okamura, J. P.; Sawyer, D. T.* (Dept. Chem., Univ. California, Riverside, CA 92502). **Gas chromatographic studies of sorptive interactions of normal and halogenated hydrocarbons with water-modified soil, silica, and Chromosorb W.** *Anal. Chem. 45(1): 80-84; 1973.* (21 references)

The sorption characteristics of fumigants of the halogenated methane type were investigated by GC, using columns of wetted soil, silica (Porasils B and C), and Chromosorb W. Adsorption on the water surface and absorption by the water layer were the principal interactions with the wetted soils since retention of the fumigants decreased with decreasing water content. Results were more reproducible when soils were brought to desired water content by desorption. Water on Chromosorb W or Porasil C appeared to be a good model for water on soil at all but very low water contents. Data from the model systems makes it possible to calculate the amount of water on the soil surface, the surface area of the aqueous layer, and retention volumes of various compounds.

74-0016. Evans, W. F. (Div. Life Sci., Univ. Arkansas, Little Rock, AR 72204). **A facility for the biological treatment of a complex chlorophenolic waste.** *Arkansas Acad. Sci. Proc. 25: 38-40; 1971.* (7 references)

Data was accumulated before and 12 months after completion of an aeration system intended to induce biological degradation of chlorophenols and chlorophenoxy acids entering the sewage treatment facility at Jacksonville, Arkansas. The information shows that chlorophenols and chlorophenoxy acids can be degraded without affecting the pH, dissolved oxygen, or types or numbers of plankton organisms and coliform bacteria. From 55 to 89% of the chlorophenols and from 30 to 70% of the chlorophenoxy acids were removed by the aeration lagoon, and a slightly greater reduction was achieved with the whole system. During normal plant operation, the concentrations of chlorophenols and chlorophenoxy acids, which came from a plant manufacturing 2,4-D and 2,4,5-T, were 0.1 mg/l. and 1.1 mg/l., respectively.

74-0017. Siyali, D. S.; Stricker, P. (Div. Anal. Lab., Dept. Pub. Health, P. O. Box 162, Lidcombe, New S. Wales, Australia). **Hexachlorobenzene and other organochlorine pesticides in milk.** *Aust. J. Dairy Technol. 28(2): 55-58; 1973.* (14 references)

Analysis of approximately 200 milk samples collected in New South Wales over a three year period indicated that the level of organochlorines in Australian milk is lower than that of most other countries and well below the standards set by WHO and FAO. A modification of the Official Method of Analysis of the Association of Official Analytical Chemists was used for the determinations which included a methanol-ether-hexane extraction, partition with acetonitrile and hexane, aluminum oxide chromatography, and analysis on a dual electron capture-tritium source GC system. DDT residues for the three years averaged 22.4, 3.3, and 5.0 ppb, and levels of BHC, dieldrin, lindane, and heptachlor were low. About 12% of the samples contained HCB (hexachlorobenzene), a significant finding since only one other survey has reported the presence of this pesticide in cow's milk. The fact that Australian cows are only stall fed during periods of drought probably is responsible for the lower pesticide residues in the milk.

74-0018. Rippon, L. E.; Glennie-Holmes, M.; Gilbert, W. S. (Dept. Agr., Citrus Wastage Res. Lab., Gosford, New S. Wales, Australia). **Behaviour of thiabendazole when used as a post-harvest dip in banana packing sheds.** *Aust. J. Exp. Agr. Anim. Husb. 13(63): 465-469; 1973.* (8 references)

Fruit skin deposits of thiabendazole averaged 1.4 ppm and 0.8 ppm after the bananas packed singly in wooden boxes were dipped in suspensions of wettable powder formulations of the fungicide. Deposits increased and decreased with dip concentration. The depletion rate averaged 21% per 25 cases. Laboratory experiments in which only surfactant was replenished indicated that flocculation might be responsible for the apparent decrease in concentration. Whole fruit residues observed in these trials were below the recommended levels set by the U. S. FDA.

74-0019. Chopra, N. M.; Thekkekandam, J. T. (Dept. Chem., N. Carolina Agr. Tech. State Univ., Greensboro, NC 27411). **A mechanistic study on the formation of the non-volatile degradation products of *p,p'*-DDT and *p,p'*-TDE in *p,p'*-DDT- and *p,p'*-TDE-treated tobacco smoke.** *Beitr. Tabakforsch. 7(2): 88-92; 1973.* (8 references)

Tobacco samples containing 20 ppm *p,p'*-DDT, 200 ppm *p,p'*-DDT, 20 ppm *p,p'*-TDE and 200 ppm *p,p'*-TDE were smoked in a vycor tube. Their smoke condensates were analyzed for breakdown products. Most of the more volatile compound, TDE, escaped degradation while only about 3% of the DDT was recovered unchanged. Higher amounts of TDE were destroyed

when the original concentration was high. From the products recovered it appeared that reactions which had lesser energy requirements occurred more readily than those which had a higher requirement. Both *p,p'*-DDE and *p,p'*-DDM were formed from *p,p'*-TDE, indicating that some dehydrogenation does occur, as well as dehydrochlorination.

74-0020. Olszyna-Marzys, A. E.; De Campos, M.; Taghi Farvar, M.; Thomas, M. (Div. Contr. Anal. Aliment, Inst. Nutr. Centro America, Guatemala). **Residuos de plaguicidas clorados en la leche humana en Guatemala. [Chlorinated pesticide residues in human milk in Guatemala.]** *Bol. Of. Sanit. Panamer. 74: 93-107; 1973.* (25 references) (Spanish)

Chlorinated pesticide residues were examined in milk from 46 nursing mothers in three rural Guatemalan communities to estimate the impact of insect control programs in Central America. Two of the communities are located in areas where cotton is intensively cultivated. Five samples of cow's milk were also analyzed to provide values for comparison in the third community, located outside the cotton-growing region. The total DDT levels ranged from 0.342 to 12.2 ppm. Samples from the cotton-growing towns contained an average of 4.07 and 1.83 ppm total DDT, and the sample from the non-cotton growing town contained an average of 2.15 ppm. Cow's milk from the non-cotton growing town contained an average of 0.025 ppm total DDT. Between one-third and one-half of the total DDT in the human milk samples was *p,p'*-DDT, with the remainder mainly comprising *p,p'*-DDE plus small amounts of *p,p'*-DDD (TDE) and *o,p'*-DDT. Total BHC values of 0-0.1 ppm were found, and traces of heptachlor epoxide, dieldrin, and endrin were present in some samples.

74-0021. Suzuki, M.; Yamato, Y.; Watanabe, T. (Kitakyushu Municipal Inst. Pub. Health, Kitakyushu, Japan). **Multiple organochlorine pesticide residues in Japan.** *Bull. Environ. Contam. Toxicol. 10(3): 145-150; 1973.* (14 references)

During a survey of organochlorine pesticide residues in soil from the Kyushu district of Japan, all 99 samples contained a mixture of BHC isomers. The ratio of isomers was much different from that found in pesticide formulations and suggested that the beta isomer is stable in soil. Mean levels of aldrin, dieldrin, and endrin were approximately in the same range as those of the BHC isomers (0.070 to 0.290 ppm), but these generally occurred in less than half the samples. DDT was found in 60 of the samples at a mean level of 1.147 ppm; DDT metabolites were found in mean levels ranging from 0.173 to 0.416 ppm.

74-0022. Newsome, W. H.; Laver, G. W. (Res. Lab., Health Protection Branch, Dept. Nat. Health Welfare, Tunney's Pasture, Ottawa K1A OL2, Ontario, Canada). **Effect of boiling on the formation of ethylenethiourea in zineb-treated foods.** *Bull. Environ. Contam. Toxicol. 10(3): 151-154; 1973.* (7 references)

Residues of ethylenethiourea (ETU) were higher in foods subjected to cooking than in the same foods before cooking. Carrots and spinach, sprayed with a 1 mg/ml suspension of a formulation containing 82.9% zineb, initially had levels of 0.073 and 0.182 ppm. A 4-fold increase was observed after they had been refluxed for 15 min. Cooking water from carrots contained 0.838 ppm and 2.70 ppm from spinach. Boiling had a similar effect on residues in apples and tomatoes treated at a level of 50 ppm zineb. ETU formation during cooking was linear over an interval of at least 1 hr.

74-0023. Godglueck, G. (Bundesgesundheitsamt, Berlin, Germany). **Wirkstoffe in der tierischen Produktion und ihre moeglichen Rueckstaende in Lebensmitteln tierischer Herkunft, dargestellt am Beispiel des Huehnereies. [Growth-promoting agents in animal husbandry and possible residues in foods of animal origin, based on the example of chicken eggs.]** *Bundesgesundheitsblatt 23/24: 355-357; 1972.* (German)

Growth-promoting agents currently used in animal husbandry include nutritive materials, sanitation aids, and drugs. Of the sanitation aids, particular attention has been focused on organochlorine insecticides from the viewpoint of residues in eggs. Organochlorines, being lipophilic, accumulate in body fat and are excreted in the eggs; organochlorine concentrations in egg yolk are in the order of magnitude of those in the body fat. Spraying of a 1% lindane suspension in a henhouse resulted in lindane levels in body fat of 131 ppm after 1 week and 151 ppm after 12 weeks. Lindane contents in the eggs were 13 and 15 ppm, and since the lipid content of the egg was about 11%, the values were nearly identical on a lipid basis. This study also points out the prolonged excretion time for chlorinated hydrocarbons. When hens were given DDT for 5 days at 15 ppm in the feed, 0.81 ppm was still detectable in the yolk after 3 months.

74-0024. Chisholm, D. (Res. Sta., Canada Agr., Kentville, Nova Scotia, Canada). **Lead, arsenic, and copper content of crops grown on lead arsenate-treated and untreated soils.** *Can. J. Plant Sci. 52: 583-588; 1972.* (12 references)

Increased lead and arsenic concentrations in the surface soil (0-15 cm), resulting from applications of lead arsenate ($PbHAsO_4$), increased both lead and arsenic levels in crops grown on treated plots. The lead levels in some crops approached or exceeded the Canadian residue tolerance of 2.0 ppm. Lead arsenate soil treatments did not affect copper absorption by crops. On areas such as old orchard land contaminated

with lead arsenate residues it may be advisable to ascertain the soil lead status before planting certain crops, and also to determine the lead affinity and arsenic sensitivity of the plants to be grown. (Author abstract by permission)

74-0025. Ritcey, W. R.; Savary, G.; McCully, K. A. (Res. Lab., Health Protection Branch, Dept. Nat. Health Welfare, Ottawa, Canada). **Organochlorine insecticide residues in human adipose tissue of Canadians.** *Can. J. Pub. Health 64(4): 380-386; 1973.* (33 references)

Human adipose tissue samples were taken during autopsies on Canadians who died of accidental causes in 1969. Organochlorine residues were detectable in all 221 samples. Mean residues were: 0.015 mg/kg lindane, 0.040 mg/kg heptachlor epoxide, 0.122 mg/kg dieldrin (HEOD), 3.430 mg/kg *p,p'*-DDE, and 1.017 *p,p'*-DDT. Wide variation was observed between individuals, and although mean levels were higher for males than females, significant differences were not noted between the sexes. Heptachlor epoxide and dieldrin residues were significantly lower in those aged 0-25 years than in the two other age groups.

74-0026. Grover, R. (Res. Sta., Agr. Can., Regina, Saskatchewan, Canada). **Movement of picloram in soil columns.** *Can. J. Soil Sci. 53(3): 307-314; 1973.* (19 references)

The movement of picloram was studied in various Canadian Prairie soils, using soil columns. Picloram was readily leached in all soil types. The movement was greatest in the soil with the lowest organic matter and clay contents, and lowest in black soils that are high in soil organic matter content. It was related, in general, to the adsorptive and water-holding capacities of these soils. The extent of leaching of picloram was also related to the total amount of water applied; the greater the amount of water the greater the downward movement. Increasing the intensity of water increments from 0.25 to 2.5 cm enhanced the movement of picloram in the clay soil but had no effect in the sandy loam. There was little or no difference in the movement of picloram when the herbicide was applied at 2.0 or 0.2 kg/ha. Picloram leached to a greater depth when the sandy loam soil was initially dry than wet and the converse was true for the clay soil. Picloram moved readily upwards when the soil columns were subirrigated. (Author abstract by permission)

74-0027. Yannai, S.; Haas, A. (Dept. Food Eng. Biotechnol., Technion-Israel Inst. Technol., Haifa, Israel). **Occurrence of lead in sesame paste and factors responsible for it.** *Cereal Chem. 50(5): 613-616; 1973.* (11 references)

Sesame paste from one factory contained an average of 2.2 ppm of lead; seeds from three different countries, whether whole or decorticated, contained about 1.7 ppm. Levels did not differ between paste stored in polyethylene jars or stored in unlacquered cans for two months at 35°, suggesting that the lead solder did not contribute to the high levels. Since inner tissue of the seeds contained the same levels as the whole seeds, lead arsenate sprays or lead air pollutants probably were not directly responsible for the residues. Lead arsenate was widely used in the past and may have contributed to contamination of the soil from which the lead was absorbed. It is unlikely that natural lead levels in soil were the same in all three countries.

74-0028. Kotzias, D.; Klein, W. ; Korte, F. (Inst. Oekol. Chem., Schloss Birlinghoven, Germany). **Beitraege zur oekologischen Chemie LVII. Reaktion des Buturons bei UV-Bestrahlung. [Contributions to ecological chemistry LVII. Reaction of buturon under UV irradiation.]** *Chemosphere 2(2): 87-90; 1973.* (3 references) (German)

Buturon, dissolved in various solvents and as the solid material, was irradiated with a mercury vapor lamp with a Pyrex filter (near UV); the photolysis products were isolated by column chromatography. After 140 hr of irradiation in methanol, buturon itself was no longer present in the solution. About 2% of the initial buturon was isolated as dechlorobuturon and about 11% as *N*-phenyl-*N'*-methylurea; the remainder was in the form of polymers and unidentified products. Aniline was detected in the oily residue obtained after evaporation of ethanol. Photochemical degradation proceeded more rapidly when a quartz filter was used; 30% of the buturon had been degraded after 25 hr of irradiation in methanol. Approximately 1% dechlorobuturon and 3% *N*-phenyl-*N'*-methylurea were isolated, and large amounts of polymer were formed. About 10% of the buturon in solid form was degraded after 17 hr of irradiation through a Pyrex filter. *N*-4-chlorophenyl-*N'*-methylurea, which is assumed to form as an intermediate in the dechlorination and cleavage of the isobutinyl group from buturon, has not yet been isolated.

74-0029. Gaeb, S.; Klein, W.; Korte, F. (Inst. Oekol. Chem., Schloss Birlinghoven, Germany). **Beitraege zur oekologischen Chemie. LVI. Photoreaktionen des Aldrin/Dieldrin-Metaboliten Dihydrochlorden-1,3-dicarbonsaeure. [Contributions to ecological chemistry. LVI. Photoreactions of the aldrin/dieldrin metabolite dihydrochlordene-1,3-dicarboxylic acid.]** *Chemosphere 2(3): 107-110; 1973.* (11 references) (German)

After dihydrochlordene-1,3-dicarboxylic acid, known as the principal metabolite of aldrin in soil and various plants and of dieldrin in mammals, was irradiated in solution or gaseous form, the reaction products were identified. Substantial amounts of cyclized and hydrogenated compounds were formed; photohydrogenation is a newly discovered reaction type for this class of

compounds. When the dimethyl ester of the title compound in 0.5% *n*-hexane solution was irradiated at wavelengths below 300 nm, dechlorination products were obtained. One of these products was present in about 85% yield after 25 minutes of irradiation. Different products were obtained on irradiation of a 1% solution of the dimethyl ester in *n*-hexane. In addition to the familiar reactions of dechlorination at the chlorinated double bond and cyclization three new reaction types were found: photoisomerization; photohydrogenation of the double bond in the chlorinated five-membered ring; and introduction of a double bond into the non-chlorinated five-membered ring with simultaneous hydrogenation of the chlorinated double bond.

74-0030. Kohli, J.; Weisgerber, I.; Klein, W. (Inst. Oekol. Chem., Gesellsch. Strahlen- Umweltforsch. mbH, Munich, Germany). **Beitraege zur oekologischen Chemie. LVIII. Zum Transport von Aldrin-^{14}C und Umwandlungsprodukten im Boden. [Contributions to ecological chemistry. LVIII. Transport of aldrin-^{14}C and transformation products in soil.]** *Chemosphere 2(3): 125-130; 1973.* (8 references) (German)

Model experiments on aldrin transport were performed outdoors using a soil-filled 60 x 60 x 60 cm box with a grating at the bottom which was placed in a metal tray to collect the outflowing water. Aldrin-^{14}C was poured on as a dilute aqueous formulation at 2.4 kg/ha over half of the box, which was separated from the other half by a glass plate extending 40 cm into the soil. Residues in the treated soil were high 1.5 years after treatment (1.367 ppm aldrin equivalent). Most of the residue was in the form of dieldrin, but small amounts of aldrin, hydrophilic metabolites (principally dihydrochlordene dicarboxylic acid), and materials not extractable with organic solvents were present. Only 0.005 ppm of residue was present in the untreated soil; i.e., about 10 times less than the fraction found under natural conditions. Almost half of this radioactivity comprised inextractable material, a finding characteristic of deep soil layers. By 2.5 years after treatment, the total radioactivity in the untreated soil was 0.008 ppm, indicating slow, continued redistribution of the radioactivity in the soil. Leaves of beets grown in untreated soil 1.5 yr after treatment of the adjacent plot contained 0.018 ppm of dieldrin-aldrin and hydrophilic metabolites. Residues could not be detected in potatoes grown on this plot at 2.5 yr.

74-0031. Takami, F.; Tokuyama, K.; Wakahara, S.; Maeda, T. (Shionogi Res. Lab., Shionogi & Co., Ltd., Fukushima, Osaka, 553, Japan). **Decomposition of dithiocarbamates. VI. The decomposition of *N*-monosubstituted dithiocarbamic acids in acidic solutions.** *Chem. Pharm. Bull. 21(3): 594-599; 1973.* (16 references)

The kinetics of decomposition of ethyl-, benzyl-, and [(4-amino-2-methyl-5-pyrimidinyl)] methyldithiocarbamic acids and methyldithiocarbamic acid were investigated over a wide range of acid concentrations. The *N*-monosubstituted dithiocarbamate was in equilibrium with its protonated form, but decomposed directly to the amine with liberation of CS_2. The rate-limiting step of N-C bond fission and a transition state structure were proposed from the linear relationship between log *k* and p*K*a of the parent amine (p*K*N).

74-0032. Takami, F.; Tokuyama, K.; Wakahara, S.; Maeda, T. (Shionogi Res. Lab., Shionogi & Co., Ltd., Fukushima, Osaka, 553, Japan). **Decomposition of dithiocarbamates. VII. The decomposition of *N*-monosubstituted dithiocarbamic acid in alkaline solutions.** *Chem. Pharm. Bull. 21(6): 1311-1317; 1973.* (20 references)

The kinetics of decomposition of methyl, ethyl, propyl, benzyl, and phenyldithiocarbamic acids to isothiocyanate and bisulfide ion were studied over a wide range of pH. First-order rate constants were proportional to the mole fraction of the anion form of the dithiocarbamic acid. Results indicated that the decomposition of the anion proceeds directly, without conversion to the conjugate base. The reverse reaction of isothiocyanate with the bisulfide ion retarded the reaction. When concentrations of dithiocarbamic acid $> 5 \times 10^{-5} M$ were used, the rates deviated from the first-order law as the reaction proceeded.

74-0033. Hamroll, B.; Jumar, A. (Forschungszent. Pflanzensch. Schaedlingsbekaempfungsm., VEB Fahlberg-List, Magdeburg, DDR). **Modelluntersuchungen zur Abbaugeschwindigkeit des Herbizids Proximpham im Boden in Gegenwart herbizider Zweitkomponenten. [Model studies on the degradation rate of the herbicide proximpham in soil in the presence of additional herbicide components.]** *Chem. Tech. (Leipzig) 25(7): 423-424; 1973.* (9 references) (German)

The effects of other herbicides on the degradation of proximpham were investigated in soil samples at 2.7% humus content, pH 7.2, 20% water content, and incubated at 16°C in Erlenmeyer flasks. A reaction gas chromatographic method permitted individual determination of the herbicides. The half-life of 4 ppm proximpham was 8.9 days in natural soil and 14.1 days in sterile soil. The half-life of proximpham alone was 15.0 days in the presence of diuron; 14.6 days in the presence of propham; 14.3 days in the presence of chlorpropham; 13.0 days in the presence of lenacil; and 12.5 days in the presence of fenuron. The secondary components were added to the soil at 0.4-0.8 ppm. The presence of these small quantities of secondary components seemed adequate to suppress the microbial degradation of proximpham almost completely so that the hydrolytic degradation rate determined the half-life.

74-0034. White, C. M.; Emison, W. B.; Williamson, F. S. L. (Dept. Zool., Brigham Young Univ., Provo, UT 84601). **DDE in a resident Aleutian Island peregrine population.** *Condor 75: 306-311; 1973.* (27 references)

Mean DDE residues in peregrine falcon eggs collected on Amchitka Island were 3.99 ppm (wet weight) in 1969, 6.96 ppm in 1970, and 1.89 ppm in 1971; corresponding shell thickness indices were 1.74, 1.73, and 1.83. DDE levels are lower than those observed in North American or Alaskan peregrines, and shell indices are significantly higher although these have decreased in comparison to pre-DDT indices found for the same birds on Forrester Island. A survey of the prey commonly consumed by the peregrine on Amchitka indicated that about 70% were resident species which contained low levels of DDE.

74-0035. Ginn, T. M. (Rice Univ., Houston, TX). **Studies on the distribution of chlorinated hydrocarbon pesticides in a ricefield-marshland ecosystem.** *Diss. Abstr. Int. 34(4): 1385B-1386B; 1973.*

Insecticides detected in components of a ricefield-marshland ecosystem included aldrin, dieldrin, DDT, DDE, and DDD (TDE). The source of the DDT was unknown; aldrin was from a seed dressing applied to rice–and the source of the dieldrin. Aldrin and dieldrin were detected in biotic and abiotic components of the ecosystem. Aldrin persisted briefly, but dieldrin persistence was extensive. Dieldrin underwent bioconcentration with a time lag prior to appearance of elevated concentrations at each higher trophic level. Dieldrin residues exhibited a first-order or concentration-dependent decline in living and nonliving materials. Aldrin and dieldrin were detected primarily in the immediate vicinity of ricefields and in ricefield runoff; residues were also present in insects and birds collected in marshlands adjacent to ricefields. Acute intoxication was observed in several bird species. Bird and fish eggs contained significant levels of residues. DDT, DDE, and DDD were detected only in biotic components of the ecosystem. Biological magnification of the residues was evident in higher trophic levels. No distinct distribution patterns were discernable over time or with respect to location of the organism within the study area. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-21,552.)

74-0036. Pesson, P. (Inst. Nat. Agron., Paris-Grignon, France). **La circulation des polluants dans la biosphere. [Circulation of pollutants in the biosphere.]** *Econ. Med. Anim. 14(1): 3-10; 1973.* (French)

Circulation of pollutants in the biosphere results in universal contamination by some pollutants and can produce dangerous concentrations in life forms far from the emission. The two main forms of pollutant transport are physical (in the form of aerosols or solutions) and biological (through the food chain); DDT can be transported in both ways. DDT has been found in snow on remote mountains and in the Antarctic, illustrating the importance of precipitation in depositing circulating pollutants, particularly long-lived ones, back on earth. DDT offers a classic example of bioconcentration. Although nearly insoluble in water, DDT is absorbed on particles suspended in water, resulting in a concentration 10,000-100,000 times that of the water. Benthic and planktonic organisms filter the water or sediment to obtain nourishment and accumulate the DDT-containing particles. In a coastal ecosystem where the DDT content of the sediments was 0.014 ppm crustaceans contained 0.41 ppm; alevins of fish consuming these crustaceans contained 3.4 ppm; gulls eating the fish had 99 ppm in muscle and 2,441 ppm in fat. Similar findings were made for terrestrial ecosystems.

74-0037. Hascoet, M. (Author address not given). **Incidence des traitements phytosanitaires sur la contamination des produits laitiers. [Frequency of contamination of dairy products by plant-protection agents.]** *Econ. Med. Anim. 14(1): 51-58; 1973.* (French)

The first thorough examination of French dairy products for pesticide residues, made in 1968, revealed an average BHC contamination of 0.71 ppm which greatly exceeded the maximum permissible quantity established in the U.S.; lower levels of contamination by DDT, dieldrin, and heptachlor epoxide were also found. The widespread use of BHC in whitewash for stables was considered the probable source of contamination; this was confirmed by spraying the stables, then determining BHC levels in milk. A mean level of 6-10 ppm BHC was maintained for two months; this would be adequate to produce a BHC level of 0.3 ppm (fat basis) if 3-5% of the barns were sprayed every two months. A ban on BHC use in stables eventually reduced the contamination level. DDT was primarily traced to corn which had been used too soon after ensiling. Examination of dietary sources for heptachlor epoxide revealed a low level of contamination of fodder (85% of samples contained $>$ 0.1 ppm dry weight) and more extensive contamination of beets (47% of samples contained 0.2-0.4 ppm dry weight). Feeding studies revealed that of the organochlorines, dieldrin and heptachlor epoxide are most readily carried over into the milk. Restricting the use of these compounds in agriculture should reduce milk contamination in France.

74-0038. Duff, W. G.; Menzer, R. E. (Dept. Entomol., Univ. Maryland, College Park, MD 20742). **Persistence, mobility, and degradation of ^{14}C-dimethoate in soils.** *Environ. Entomol. 2(3): 309-318; 1973.* (15 references)

Dimethoate-carbonyl-^{14}C, applied to silty loam, loamy sand, and clay loam contained in the ground at two dose levels, was converted to dimethoxon, small amounts of dimethoate carboxylic acid, and two

unknown radioactive metabolites. Soil type did not significantly influence the rate of conversion, the products obtained, the total recovery of radioactivity, or the proportion of material not extracted from the soil, but downward movement of dimethoate was slightly greater in loamy sand soil. Higher soil moisture content, observed in the experiment involving the higher dose level, promoted greater downward movement and more rapid disappearance of the dimethoate-^{14}C-equivalents. Less than 1% of the applied radioactivity was recovered from the 2nd inch after five weeks under relatively dry conditions; however, residues were found as far down as 4 inches after three weeks under wetter conditions. Non-extractable residues were not neutral phosphorus esters, and therefore are probably nontoxic. Less than 0.5% of the applied dose was recovered from corn and bean plants grown in the soil.

74-0039. Getzin, L. W. (Western Washington Res. Extension Cent., Washington State Univ., Puyallup, WA 98371). **Persistence and degradation of carbofuran in soil.** *Environ. Entomol. 2(3): 461-467; 1973.* (12 references)

Laboratory studies indicated that rapid chemical hydrolysis is responsible for the degradation of carbofuran in alkaline soils although some chemical and microbial degradation occurs in acid soils. Half-lives varied from 4 to > 54 weeks, depending on soil type. Sterilization had no effect on the degradation rate of carbofuran in Ritzville silt loam and only a slight effect in the Sultan and organic soils tested. Most of the ^{14}C was recovered from the degraded carbonyl-labeled carbofuran as $^{14}CO_2$. The amount of bound radioactivity increased to levels as high as 71% of the applied radioactivity and then gradually decreased. Carbofuran phenol yielded similar results. Carbofuran is probably hydrolyzed to the phenol, immediately bound to the soil constituents, and slowly metabolized by microorganisms.

74-0040. Parslow, J. L. F.; Jefferies, D. J. (Monks Wood Exp. Station, Abbots Ripton, Huntingdon, England). **Relationship between organochlorine residues in livers and whole bodies of guillemots.** *Environ. Pollut. 5(2): 87-101; 1973.* (23 references)

Polychlorinated biphenyls (PCBs), DDE, and dieldrin residues were compared in livers and carcasses of guillemots dying of natural causes (Group I) and those shot as game birds (Group II) in the Irish Sea area. Levels of PCBs and DDE in carcasses were similar in both groups, 3.0 and 1.0 ppm, respectively; dieldrin levels were 0.1 in Group I and 0.3 in Group II. Liver levels of PCBs, DDE, and dieldrin averaged 50, 9.7, and 0.48 ppm in Group I and 0.53, 0.18, and 0.09 ppm in Group II. The calculated regression equations for PCBs and known liver residues were used to estimate total body loads for 39 birds from Group I which had been found during an unexplained massive loss of the birds. Calculated residues averaged 4660 μg and suggested that PCBs could have been a mortality factor.

74-0041. Debska, W.; Domeracki, S. (Inst. Przemyslu Zielarskiego, Libelta 27, Poznan, Poland). **Oznaczanie pozostalosci pestycydow i produktow ich degradacji w surowcach i lekach pochodzenia roslinnego. Cz. 1. Zawartosc insektycydow chlorowcopochodnych w koszyczkach rumianku (*Anthodium chamomillae*), ze zbiorow 1971 r. [Determination of residual pesticides and their degradation products in crude and plant drugs. Part 1. The content of organochlorine insecticides in *Anthodium chamomillae*, 1971 year crop.]** *Herba Pol. 19(11): 15-22; 1973.* (7 references) (Polish)

Pollution of camomile samples from the 1971 crop was investigated on 30 samples of Matricaria from 15 Polish provinces. TLC was used for qualitative analysis and GLC for quantitative analysis after sample purification. Contamination from DDT and its metabolites, lindane, and methoxychlor were investigated. DDT and its metabolites averaged 0.24 ppm in crude drug cultivated samples and 0.27 ppm in those growing wild; contents had decreased as compared to 1969. Lindane and methoxychlor contamination was insignificant, and the samples were considered free of these compounds: contents varied from 0.00 to 0.02 (Krakow) for lindane and from 0.00 to 0.07 (Wroclaw) for methoxychlor.

74-0042. Kim, T. (Author address not given). **[Organochlorine pesticide residues in food.]** *Hwahak Kwa Konggop Ui Chinbo (Progr. Chem. Ind.) 12(3): 317-319; 1972.* (3 references) (Korean)

Oil-soluble organic pesticides can seriously damage the human body by accumulating in the adipose tissues while water-soluble inorganic pesticides can eventually be excreted. When accumulated, inorganic toxic pesticides cause chronic toxic effects. Most agricultural products contaminated by organic pesticides contain few residues after the outer skin is removed or after heating, cooking, or processing in some way; 50% of DDT, DDD (TDE), DDE, and lindane present in fruit can be removed by washing, peeling, and coring. Other studies have shown that 33% of 62% of DDD (TDE), DDT, and lindane residues in cattle feed and food can be removed by heating and cooking. The experiments of Baldwin, Ritchy, Young, and Essary are reviewed. Considering the possibilities of long-term accumulation and chronic effects, the standards for maximum allowable residues in food must be strictly enforced, and total prohibition of the use of organochlorine pesticides should be considered.

74-0043. Singh, K.; Gulati, K. C.; Dewan, R. S. (Indian Agr. Res. Inst., New Delhi, India). **Persistence of disyston residues in soil and plant.** *Indian J. Agr. Sci. 42(12): 1135-1138; 1972.* (5 references)

Soil samples were collected from a sorghum field immediately after application of disyston (disulfoton) (5% granular) at 0.5, 1.0, and 1.5 g per 30 cm row. Enzymatic estimation of residues showed levels of 19.06, 42.50, and 61.25 ppm, respectively. Colorimetric analysis yielded slightly higher results, probably because of the interference of phosphorus from the soil. Residues were not detected in the soil treated with 1.5 g of 5% granules after 64 days in a 1967 experiment and after 85 days in a 1968 experiment, residues dissipated more rapidly from plots treated with the lower doses. Leaching and runoff were greater in 1967 and corresponded with the extensive rainfall that year. Maximum residues appeared in plants 15 days after sowing in 1967 and 17 days after sowing in 1968. Residues were not detected in grain and fodder at harvest. Oxidation of either plant or soil samples resulted in much higher values and permitted detection of low levels of disyston residues since the oxidation products inhibited ChE more than disyston itself did, but this complicates residue data.

74-0044. Deshmukh, S. N.; Dutta, S. C. (Punjab Agr. Univ., Ludhiana, India). **Study of the residues of DDT and endrin in or on maize by gas-liquid chromatography.** *Indian J. Agr. Sci. 43(1):94-96; 1973.* (9 references)

Maize from plots treated with doses of DDT and endrin recommended for control of maize-borer did not contain detectable DDT residues in the grains at milk stage; however, an unidentified compound present in the technical product was detected, and was observed in cobs formed after the last spray. The peak height of the unidentified residue was reduced 30.8% by boiling the corn or 14.6% by roasting it. Fodder contained an average of 1.49 ppm *p,p'*-DDT and some of the unidentified material, the total being below the 7 ppm tolerance fixed by the U.S. FDA. A negligible amount of the unidentified residue, but no DDT, was found in the grains, and chapati-making reduced the unidentified residue by 20%. Endrin residues in grains at the milk stage were not detectable, but an unidentified residue, also in the technical product, was found; this was reduced about 44% by boiling. Endrin was found in none of the grain samples and only in one fodder sample (at a level of 1.07 ppm). Residues of the unidentified material, however, were found in both, suggesting that use of these as food may be hazardous. Chapati-making reduced the residues 32 to 41% depending on the type of formulation used during applications.

74-0045. Tripathi, H. C.; Bahga, H. S.; Soni, B. K. (College Vet. Med., Uttar Pradesh Agr. Univ., Pantnagar (Nainital), Uttar Pradesh, India). **DDT residue in feed and body fat of animals in Uttar Pradesh.** *Indian Vet. J. 50(5): 396-399; 1973.* (10 references)

DDT was determined in poultry feeds, concentrates, hay, and other feeds collected from Haldwani, Kichha, and Pantnagar and in buffalo fat samples from Rampur, Bareilly, Haldwani, and Pantnagar. Mean residues found were 0.84 ppm in poultry feeds, 0.69 ppm in concentrate ration, 0.41 ppm in grains, 11.50 ppm in jowar seeds, and from 0.40 to 1.43 ppm in other seeds. Buffalo fat taken from animals under 10 years old contained 0.28 ppm while residues from older animals averaged 0.57 ppm.

74-0046. Menges, R. M.; Tamez, S. (Agr. Res. Serv., U.S. Dept. of Agr., Weslaco, TX). **Effect of soil incorporation on selectivity, movement, and persistence of herbicides on onion plantings.** *J. Amer. Soc. Hort. Sci. 98(4): 390-393; 1973.* (7 references)

Bioassays indicated that bensulide, applied to fields prior to planting onions, persisted for six months; little activity was observed 12 months after 4.5 and 9.0 kg/ha of bensulide were incorporated in the soil. Soil incorporation and increased rate of application increased the persistence of the herbicide. Rainfall did not move the bensulide out of its zone of incorporation. DCPA and propachlor did not persist for six months. DCPA reduced the yield of onions.

74-0047. Watanabe, I. (Fac. Agr., Iwate Univ., Iwate, Japan). **Decomposition of pesticides by soil microorganisms-special emphasis on the flooded soil condition.** *JARQ (Jap. Agr. Res. Quart.) 7(1): 15-18; 1973.* (20 references)

The persistence of pesticides in flooded and upland soil is reviewed. Degradation of PCP was primarily achieved by bacteria and occurred at a more rapid rate in flooded soil. Soil flooding accelerated the rate of degradation of propanil and decreased the rate of degradation of swep. Diphenyl ethers and most of the organochlorine insecticides tested (BHC, DDT, TDE, methoxychlor, and heptachlor) disappeared more rapidly under flooded conditions. Several of the organophosphates are hydrolyzed to products which cannot be further degraded in flooded soil. In some cases primary metabolic routes differ depending on the condition of the soil.

74-0048. Hill, I. R. (ICI Plant Protection Ltd., Jealott's Hill Res. Station, Bracknell, Berkshire, England). **Insecticides.** *J. Appl. Chem. Biotechnol. 22(7): 879; 1972.*

Leaching, volatilization, plant uptake and metabolism, and chemical and microbial degradation, as well as adsorption on soil colloids contribute to the removal of insecticides from soil. Relatively few biochemical reactions are involved in insecticide metabolism. These include oxidation, hydrolysis, dehalogenation, reduction, dehydration, and cometabolism. Most studies on insecticide degradation are inadequate due to their lack of applicability to field conditions. (Summary of a paper presented at a symposium sponsored by the Micro-

biology Group of the Society of Chemical Industry, Feb. 3, 1972.).

74-0049. Wright, S. J. L. (School Biol. Sci., Univ. Bath, Bath, Somerset, England). **Microbiological aspects of the breakdown of herbicides in the environment.** *J. Appl. Chem. Biotechnol. 22(7): 880-881; 1972.* (3 references)

The persistence of herbicides varies and ranges from several weeks for phenylcarbamates and phenoxyalkanoates to many months for triazines and substituted benzoates. A dearth of information concerning the complex field situation is apparent although degradation of herbicides by isolated organisms has been studied extensively. Phenylcarbamates and phenylanilides are generally inactivated by the formation of aniline compounds, but the persistence and toxicity of some chloroanilines and chloroazobenzenes suggests that these residues should be carefully monitored in soil. Practical uses, such as antidotal application of microbial preparations on spillage of herbicides, have resulted from investigation of the breakdown of these chemicals in the soil. (Summary of a paper presented at a symposium sponsored by the Microbiology Group of the Society of Chemical Industry, Feb. 3, 1972.)

74-0050. El-Refai, A.; Mowafy, M. M.* (Central Agr. Pestic. Lab., Min. of Agr., Cairo, Egypt). **Propanil hydrolysis: inhibition in rice plants by diazinon and carbaryl translocated from the soil.** *J. Ass. Offic. Anal. Chem. 56(5): 1178-1182; 1973.* (8 references)

Greenhouse and laboratory experiments were designed to determine the effect of soil-applied carbaryl and diazinon on the phytotoxicity of foliage-sprayed propanil. A time-course study of the activity of propanil-hydrolyzing enzyme in rice indicated a slow increase in the rate of hydrolysis during early stages of growth, followed by a sharp increase for extracts of the 7-week-old samples. The rate of hydrolysis reached its maximum at harvest time (approximately 17 weeks). The enzyme activity of barnyard grass was not detected at different growth stages. The enzyme was inhibited by diazinon and strongly inhibited by carbaryl absorbed and translocated from the soil over a wide range of growth stages of rice. Rice plants were more susceptible at early stages of growth, and this confirms the significant correlation between growth stage and enzyme activities. Analyses of tissue extracts by paper chromatography and an enzyme inhibition method agreed closely at all intervals. It seems probable that the inhibition rate of enzyme is related to the persistence and rate of translocation of carbaryl. (Author abstract by permission)

74-0051. Fries, G. F.; Marrow, Jr., G. S. (Animal Sci. Res. Div., U. S. Dept. of Agr., Beltsville, MD). **Relationship of milk fat and body fat concentrations of organochlorine compounds in cows.** *J. Dairy Sci. 55(5): 706; 1972.*

Data was pooled from 4 experiments with dieldrin, DDT, DDD, DDE, or a polychlorinated biphenyl (Aroclor 1254). The constant intake ranged from 10 mg/day DDE to 200 mg/day Aroclor 1254. Samples of body fat were obtained at several times during and after feeding and ranged from .15 to 60 μg/g. At any given time during feeding and at all times after feeding, the milk fat-body fat relationship was described for all compounds by the general equation $Y = bX$, where Y is μg/g in milk fat, X is μg/g in body fat, and b is a constant. During feeding, b was greater than 1 and decreased as the feeding period increased. At 60 days b was 1.53 (1.38 to 1.70, $P < .05$). After feeding stopped, pooled data for all times and all compounds was described by the same b, .74 (.71 to .77, $P < .05$). When the source of contamination is removed, body fat levels reliably estimate future milk levels of organochlorine compounds if the cows are not lactating. Similarly, compounds in milk fat reliably estimate those in body fat if the cow is lactating. (Author abstract by permission)

74-0052. Pass, B. C.; Dorough, H. W. (Dept. of Entomol., Univ. of Kentucky, Lexington, KY 40506). **Insecticidal and residual properties of EC and encapsulated formulations of methyl parathion sprayed on alfalfa.** *J. Econ. Entomol. 66(5): 1117-1119; 1973.* (4 references)

Encapsulated (Pencap M) and standard EC formulations of methyl parathion gave excellent and equal control of alfalfa weevil, *Hypera postica* (Gyllenhal), larvae when applied as foliage sprays. There were no differences in levels of insecticide deposits or in dissipation rates of methyl parathion from alfalfa treated with these two formulations. (Author abstract by permission)

74-0053. Saha, J. G.; Burrage, R. H.; Nielsen, M. A.; Sumner, A. K. (Agr. Can. Res. Sta., Univ. Campus, Sasakatoon, Saskatchewan, Canada). **Chlordane residues in potatoes grown in treated soil and their reduction by home processing.** *J. Econ. Entomol. 66(5): 1125-1127; 1973.* (8 references)

The application of chlordane at estimated rates of 5.0, 7.5, and 10.0 lb/acre resulted in 2.18, 3.03, and 3.54 ppm residues, respectively, in the soil immediately after the toxicants were incorporated into the soil. These levels declined to 1.48, 1.89, and 2.21 ppm, respectively, after 90 days when potatoes grown in the treated soil were harvested. Potatoes had 0.04, 0.09, and 0.11 ppm residues, respectively. Boiling the unpeeled potatoes removed only 11 to 27% of the residue, while peeling removed more than 90%, and peeling and boiling removed virtually all the residues. (Author abstract by permission)

74-0054. McGaughey, W. H. (Stored-Rice Insects Res. Lab., Agr. Res. Serv., U.S. Dept. of Agr., Beaumont, TX 77706). **Dichlorvos vapor for insect control in a rice**

mill. *J. Econ. Entomol. 66(5): 1147-1151; 1973.* (12 references)

An average dose of 63.5 g/1000 m^3 dispensed over 6 h once a week for 2 weeks in each of 7 rooms of a rice mill produced average concentrations of 4.52 to 6.26 μg of dichlorvos/liter of air. This concentration caused higher mortalities among caged test insects than a routine pyrethrins fog: 3-4.5 times higher among adult cigarette beetles, *Lasioderma serricorne* (F.); 48-92 times higher among adult red flour beetles, *Tribolium castaneum* (Herbst); 3-5.5 times higher amoung adult lesser grain borers, *Rhyzopertha dominica* (F.); and 5-7 times higher among larvae of the almond moth, *Cadra cautella* (Walker). The dichlorvos treatments caused a decrease in the insect population of the mill to the pretreatment level. Residues on bagging materials exposed to as many as 13 successive daily treatments (by moving the materials from room to room) were relatively low on cotton (≤531.8 μg/dm^2) and paper (≤669.5 μg/dm^2), but high on burlap (as much as 3752.4 μg/dm^2). Bulk products exposed similarly had residues as follows: 4.48 ppm on rough rice, 1.29 ppm on brown rice, 1.18 ppm on milled rice, and 8.26 ppm on bran. Milled rice and bran exposed in burlap bags had about the same amount, and milled rice exposed in paper bags had about as much residue. Spillage and sweepings exposed to single treatments had residues as follows: 0.67 ppm on rough rice, 0.56 ppm on brown rice, 0.72 ppm on hulls, 1.00 ppm on broken milled rice, and 7.12 ppm on bran. (Author abstract by permission)

74-0055. Krueger, H. R.; Lindquist, R. K.; Mason, J. F.; Spadafora, R. R. (Dept. Entomol., Ohio Agr. Res. Dev. Cent., Wooster, OH 44691). **Application of methomyl to greenhouse tomatoes: greenhouse whitefly control and residues in foliage and fruits.** *J. Econ. Entomol. 66(5): 1223-1224; 1973.* (1 reference)

Disappearance of methomyl residues from tomato fruits was measured after repeated spray application at rates effective for greenhouse whitefly control. In bioassay tests where adult whiteflies were caged on tomato leaves at intervals after treatment, mortality dropped to 50% of the initial rate within seven days after spraying with 0.03% AI, but remained at 98% seven days after spraying with 0.06% AI. Tomato extracts prepared by a modified Pease and Kirkland method were analyzed by gas chromatography; recovery from spiked tomatoes averaged 60%. When plants were sprayed three times at 7-day intervals, some buildup of residues was noted: tomatoes contained 0.11 ppm methomyl six days after the first spray, 0.18 ppm seven days after the second spray, and 0.35 ppm seven days after the third spray with 0.03% AI. When a 0.06% AI solution was used, residues were 0.53 ppm six days after the first spray, 0.65 ppm seven days after the second spray, and 0.59 ppm seven days after the third spray. Methomyl apparently volatilized from treated plants since the numbers of adults on check plants declined by 80% on the first day after treatment.

74-0056. Kahn, S. U. (Res. Station, Canada Dept. Agr., Regina, Saskatchewan, Canada). **Interaction of bipyridylium herbicides with organo-clay complex.** *J. Soil Sci. 24(2): 244-248; 1973.* (15 references)

Paraquat and diquat were adsorbed by montmorillonite in amounts approximately equal to and slightly less than the cation exchange capacity of the clay, respectively. A similar pattern of adsorption was observed with a laboratory-prepared fulvic acid-montmorillonite complex although adsorption on a "per unit basis" was considerably lower. When considered on the basis of 1 g of montmorillonite and 1 g of montmorillonite complexed with fulvic acid, adsorption was enhanced by the organic matter. At a saturating concentration of herbicide (1200 μmole/g), 597 and 532 μ mole/g were adsorbed by the organo-clay complex while 445 and 420 μ mole/g were adsorbed by the clay. IR studies of the interaction of organo-clay material with paraquat and diquat indicated the formation of charge-transfer complexes.

74-0057. Theobald, J. (Cincinnati Zool. Park, Cincinnati, OH 45200). **DDT levels in the sea lion.** *J. Zoo Anim. Med. 4(2): 234; 1973.*

Samples of smelt, mackerel, and herring, used as food for sea lions at the Cincinnati Zoo, contained from 0.35 to 1.27 ppm total DDT, 0.01 to 0.06 ppm dieldrin, 0.06 to 0.10 ppm mercury, and 0.40 to 0.80 ppm lead. Body fat from a dead sea lion contained 2040 ppm DDE, and liver from the same animal contained 972 ppm. Subcutaneous fat from a bear which had been fed the smelt as a small part of its diet contained only 1.71 ppm DDE. Sea lions found dead along the California coast had levels of 1200 to 1500 ppm total DDT. It is possible that the sea lions, which have a diet consisting primarily of fish, accumulate large amounts of the pesticide. In an anorectic condition this may be mobilized, resulting in pesticide toxicity.

74-0058. Verma, S.; Handa, S. K.; Misra, S. S.; Dewan, R. S. (Div. Entomol., Indian Agr. Res. Inst., New Delhi-12, India). **Dissipation of parathion residues from soybean *Glycine max* crop.** *Labdev 10-B(2): 90-92; 1972.* (3 references)

Average deposits of parathion on leaves of soybean sprayed with 0.025, 0.05, and 0.1% emulsion sprays were 4.43, 10.42, and 27.39 ppm, respectively. The half-life was calculated as 4.15 days under the prevailing conditions. Residues and half-life on green pods were similar to those on leaves. Sixteen days after application residues were still > 1 ppm at the highest application rate. Matured grains did not have detectable parathion residues at harvest after any treatment.

74-0059. Heppleston, P. B. (Seals Res. Div. (IMER), c/o Fisheries Lab., Lowestoft, Suffolk, England). **Organo-**

chlorines in British grey seals. *Mar. Pollut. Bull. 4(3): 44-45; 1973.* (6 references)

During an investigation of organochlorine residues in grey seals from four locations around the British coast, polychlorinated biphenyls (PCBs) accounted for at least half the organochlorines, total DDT ranged from 5.6 to 10.7 ppm of blubber, and dieldrin levels were between 0.14 and 0.27 ppm. Dieldrin levels did not vary markedly with location or between young and old seals. North Sea seals appeared to have higher polychlorinated biphenyl residues than those from the west and north of Britain. Mothers contained about twice as much PCBs and DDT as pups. Liver and kidney, in that order, contained the next largest amounts of organochlorine residues.

74-0060. Miller, G. J.; Fox, J. A. (Queensland Government Chem. Lab., Brisbane, Q. 4000, Australia). **Chlorinated hydrocarbon pesticide residues in Queensland human milks.** *Med. J. Aust. 2(6): 261-264; 1973.* (9 references)

Relatively high levels of DDT, dieldrin, and hexachlorobenzene and low levels of lindane were found in 40 human milk samples from Brisbane and Mareeba. DDT levels were significantly higher in samples from the urban area (16.90 ppm fat) than in rural samples (8.60 ppm fat), and hexachlorobenzene residues were significantly higher in rural samples (2.20 ppm fat) than in those from the urban area (1.23 ppm fat). The calculated average daily intakes of DDT, dieldrin, and hexachlorobenzene by breast-fed babies from both areas were higher than the acceptable daily intakes recommended by the FAO/WHO.

74-0061. Copplestone, J. F.; Hunnego, J. N.; Harrison, D. L. (Vector and Biol. Control, WHO, Geneva, Switzerland). **Organochlorine insecticide levels in adult New Zealanders—a five-year study.** *N. Z. J. Sci. 16(1): 27-39; 1973.* (14 references)

Between 1965 and 1969 biopsy fat specimens were taken from 254 New Zealand adults for conditions not related to insecticide toxicity during surgery. All contained DDT and DDE. Detectable amounts of dieldrin, lindane, and TDE were present in 94%, 7%, and 2% of the patients, respectively. Total DDT residues were higher in males than in females, and the difference was significant in those over 50 years old. Significantly higher dieldrin residues were found in males under 50. Residues of both dieldrin and DDT were higher in those occupationally exposed to insecticides than in those using them around the home. Geographic location also influenced residues. A decrease in storage, occurring from 1965 onward, reflected a phasing-out of the use of organochlorines in New Zealand.

74-0062. Nakahara, T.; Takase, I.; Yoshimoto, Y. (Research Inst., Nihon Tokushu Noyaku Co., Ltd., Japan). **[Residues of trichlorfon in eel and carp.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 75-76; 1973.* (Japanese)

The fate of trichlorfon, used for controlling *Lernaea cyprinacea* (a parasite of eels and carp), was studied in water and in fish under laboratory and field conditions. Trichlorfon at 1 ppm was added to the water in which three eels were bred. The eels were extracted with acetonitrile one and five days after the addition of trichlorfon and the extract was analyzed by GLC-FTD. With carp trichlorfon was added at 0.25 ppm. Results showed when the water was neutral or alkaline, trichlorfon decomposed in a short time to form dichlorvos. With the normal pH of 8-10 in pond water of eels, the applied trichlorfon degraded to less than 10% of the original amount after 30 min, and dichlorvos was detected. The residual amount of trichlorfon in eel body and the concentration of trichlorfon in the water were related. When the pH of the water was 7, both trichlorfon and dichlorvos were detected in the eel; these could be removed by washing. In field ponds trichlorfon was detected in the internal organs of only one out of seven cases. In carp trichlorfon and dichlorvos could not be detected one day after adding trichlorfon to water.

74-0063. Nasim, A. I.; Baig, M. M. H.; Lord, K. A. (Toxicol. Pestic. Lab., Dept. Plant Protection, Karachi 27, Pakistan). **Loss of diazinon from Dacca paddy field soils.** *Pak. J. Sci. Ind. Res. 15(4): 330-332; 1972.* (4 references)

Approximately 30% of the diazinon exposed to six different paddy soils in still percolating water was decomposed in four hours. No significant degradation took place with the absence of soil. Decomposition was negligible after heat sterilization of the soil, and a brown growth, which was isolated from the soil and was possibly an actinomycete, degraded the pesticide. Degradation was proportional to time and concentration of organism only until about 50% of the diazinon had disappeared, suggesting that decomposition was dependent on diazinon concentration or inhibited by the reaction products. Very little adsorption of the pesticide took place when one of the soils was exposed briefly to diazinon solution.

74-0064. Smith, R. A.; Belles, W. S.; Shen, K. W.; Woods, W. G. (U.S. Borax Res. Corp., Anaheim, CA 92801). **The degradation of dinitramine (N^3,N^3-diethyl 2,4-dinitro-6-trifluoromethyl-*m*-phenylenediamine) in soil.** *Pestic. Biochem. Physiol. 3(3): 278-288; 1973.* (6 references)

Sixty days after treatment of a 2:1 mixture of Anaheim silty loam and sand under greenhouse conditions with labeled dinitramine at 1/2 lb/acre, 85% of the radioactivity was found in the upper three inches, and the remaining material was found in the next six inches. Most of the aqueous methanol-extractable residue was

dinitramine and a benzimidazole metabolite, and small amounts of dealkylated products of both compounds were observed. In field studies the same metabolites were found, and dinitramine had dropped to about 5% of the original level (0.6 ppm) in 244 days. Approximately 20% of the radioactivity was lost through evaporation, evolution of $^{14}CO_2$, or leaching. A major portion of the residue was bound to the soil and could be removed only by basic or anionic surfactant extraction.

74-0065. Barnes, R. D.; Bull, A. T.; Poller, R. C. (Depts. Chem. Microbiol., Queen Elizabeth Coll., Campden Hill Rd., London, W8 7AH, England). **Studies on the persistence of the organotin fungicide fentin acetate (triphenyltin acetate) in the soil and on surfaces exposed to light.** *Pestic. Sci. 4(3): 305-317; 1973.* (28 references)

After incorporation of radiolabeled fentin acetate into sterile or nonsterile soil, the amount of fentin acetate recoverable by extraction with a variety of solvents decreased steadily, falling below 50% by 50 days after treatment. Fentin acetate was rapidly hydrolyzed in distilled water. Tri-, di-, and monophenyltin products resulting from photodegradation were separated by TLC using a butanol-acetic acid (100:1) system. Monophenyltin and inorganic tin compounds remained at the TLC origin, but could be distinguished by the UV absorbance of the phenyl group. Irradiation of plates for more than one hour resulted in complete breakdown of fentin acetate into inorganic tin. Neither fentin acetate nor any abiotic transformation product was eluted from sterile treated soil, leached at a flow rate of 12 ml/hr for six weeks. A variety of microorganisms was isolated from soil enriched with fentin acetate after 150 days of incubation. Two *Aspergillus* species and one Gram-negative rod bacterium readily metabolized fentin acetate. After an initial depression following fentin acetate treatment nitrification recovered and soon proceeded at a faster rate than in control soil. Kinetic studies of $[^{14}C]CO_2$ evolution from soil suggest that Sn-C bonds in triphenyltin compounds are more labile than those in diphenyltin and monophenyltin compounds; the latter are more strongly adsorbed to soil.

74-0066. Juzwiak, I.; Juzwiak, J.; Suchowiak, J.; Orda, E. (District Station of Hyg. and Epidemiol., Wroclaw, Poland). **Badania stopnia zagrozenia pestycydami zdrowia pracownikow rolniczych zakladow pracy pow. olesnickiego. [Studies on the exposure of agricultural workers to pesticides in the Olesnicki district.]** *Pol. Tyg. Lek. 28: 419-422; 1973.*(7 references) (Polish)

Concentrations of DDT, 2,4-D, MCPA, mercury, and thiram were determined in air samples collected at 40-60 minute intervals from different areas of pesticide and herbicide warehouses. Workers employed at stations where pesticides were accepted or dispensed were most endangered. DDT concentrations ranged between 0.0017 and 0.019 mg/l. air, 2,4-D concentrations between 0.0012 and 0.0036 mg/l. air, and MCPA concentrations between 0.001 and 0.003 mg/l. air. The average concentration of mercury in the immediate vicinity of grain treatment stations ranged between 0.000011 and 0.000032 mg/l. air and thiram between 0.001 and 0.0018 mg/l. In addition, concentrations of these pesticides on tractors and in the air during and shortly after spraying of fields were extremely high and endangered the health of workers, including those within 20-120 meters of spraying. It was concluded that protective measures in warehouses were inadequate because of lack of ventilation and running water and inadequate sealing where needed.

74-0067. Lee, R. K.; Peoples, S. A. (Dept. Physiol. Sci., Univ. of California, Davis, CA 95616). **Cigarette smoking and its effects on the urinary DDA levels in man.** *Proc. West. Pharmacol. Soc. 16: 240-243; 1973.* (9 references)

A method based on the formation of dichlorobenzophenone (DBP) was tested as an indicator of the presence of DDA, the primary metabolite, in human urine. Urine was heated with glacial acetic acid and chromium trioxide, cooled, extracted with hexane, and the extract analyzed by electron capture GLC. The method required only 5 ml of urine, gave an average of 91.2% recovery, and was sensitive to 1 ng/ml. Urine from 16 nonsmokers, tested in this way, contained an average of 4.6 ng DDA/ml; urine from 8 smokers contained an average of 33.7 ng/ml. The increase in DDA excretion in smokers is probably due to increased metabolism by microsomal enzymes since fat storage of DDT has been shown to be similar in smokers and nonsmokers.

74-0068. Prestt, I. (Cent. Unit Pollut., Dept. Environ., London, England). **The scientific critique of pollution and conservation.** *Pub. Health (London) 85: 265-274; 1971.*

A detailed history of the organochlorine insecticides as environmental pollutants illustrates features common to many contaminants. Even in situations in which the use of these pesticides has been relatively limited, as in the case of seed dressings, unexpected and widespread contamination via concentration in the food chain has resulted. Many years have elapsed between the introduction of the compounds and the discovery of striking effects (eggshell thinning) by results of field studies. Thirty years elapsed before polychlorinated biphenyls were recognized as a worldwide contaminant. Wild birds have been used successfully to monitor levels of organochlorines, and, since they are relatively high in the food chain, problems associated with detection limit levels of pesticides generally did not arise.

74-0069. Plimmer, J. R.; Klingebiel, U. I. (Pestic. Degradation Lab., Agr. Environ. Quality Inst., Agr. Res. Serv.,

Beltsville, MD 20705). **PCB formation.** *Science 181(4104): 994-995; 1973.* (5 references)

In a Letter-to-the-Editor previously published data on the photolysis of DDT was reviewed. "DDT: an unrecognized source of polychlorinated biphenyls" did not deal with a novel reaction. DDMU, dichlorobenzophenone, and dichlorobiphenyl had been shown to be products of DDT or DDE photolysis in methanol at 260 nm, and 4,4′-dichlorobiphenyl had been reported as a product of dichlorobenzophenone photolysis. Photooxidation of DDE to 3,3′-dichlorobiphenyl-2-carboxylic acid had also been demonstrated, and decarboxylation of this acid could yield traces of PCBs (polychlorinated biphenyls).

74-0070. Hayes, M. H. B.; Pick, M. E.; Toms, B. A. (Dept. Chem., P. O. Box 363, Univ. Birmingham, Edgbaston, Birmingham B15 2TT, England). **Application of microcalorimetry to the study of interactions between organic chemicals and soil constituents.** *Science Tools 19(1): 9-12; 1972.* (11 references)

The recent introduction of the LKB Batch Microcalorimeter has made it possible to determine enthalpy changes which accompany interactions between small organic molecules like herbicides and soils or soil components. During an extensive study of the adsorption of diquat and paraquat on montmorillonite clay preparation, this technique was adapted and used successfully. Areas of millivoltage-time curves obtained from the microcalorimeter were always proportional to energy supplied and were corrected for the average 2% error of the individual determination. The interaction between sodium-montmorillinite and the herbicides was highly exothermic. The enthalpy change was directly proportional to the amount of diquat or paraquat employed until the known cation exchange capacity of clay was reached. The molar adsorption energy of diquat was significantly smaller than that of paraquat; in both cases, the energy was independent of the amount adsorbed.

See also 74-0076 74-0094 74-0142 74-0155 74-0170 74-0188 74-0224 74-0230 74-0247 74-0250

74-0071. Laws, E. R. Jr.; Maddrey, W. C.; Curley, A.; Burse, V.,W. (Dept. of Neurol. Surgery, Mayo Clinic, Rochester, MN 55901). **Long-term occupational exposure to DDT.** *Arch. Environ. Health 27(5): 318-321; 1973.* (30 references)

The hepatic effects of long-term occupational exposure to high levels of DDT were investigated. Workers exposed to equivalent oral intakes of 3.6 to 18 mg daily for periods averaging 21 years were studied. Based on the findings of extensive medical inquiries, liver function tests, and DDT serum levels, no evidence of hepatic disease or liver function abnormalities was detected. (Author abstract by permission)

74-0072. World Wildlife Fund (1110 Morges, Switzerland). **Western Europe's sea eagles raise only one young in 1972.** *Biol. Conserv. 5(1): 57; 1973.*

As in three preceding years, the remaining sea eagles in western Europe outside Scandinavia produced only one bird successfully in 1972. Although four pairs built nests, two failed to produce young and one 2-day-old bird was killed by a marauder despite the presence of volunteer guards. Hunting and pesticide residues in the diets have apparently severely affected the population of sea eagles. In 1972 and in 1971, the only breeding success was by a pair which had been provided with non-contaminated food during the winter.

74-0073. Anonymous. **Parathion poisoning alert.** *Clin. Pediat. 12(9): 511-512; 1973.* (4 references)

Since accidental parathion poisoning is expected to be observed more frequently with the general ban on DDT in the U. S., physicians and hospital personnel should be ready to diagnose and treat such cases. The estimated lethal dose for an adult is 20 mg which may be absorbed through the skin, lungs, or gastrointestinal tract. Parasympathetic effects usually appear first and include anorexia, nausea, sweating, and epigastric and substernal tightness; in more severe cases, abdominal cramps, diarrhea, salivation, and excessive bronchial secretion occur. Twitching, muscle fasciculations and cramps, followed by weakness, ataxia, and paralysis, generally appear after parasympathetic effects have reached moderate severity. Central nervous system effects such as tension, headache, and tremor may occur and lethal or near lethal doses of the insecticide may produce convulsions, areflexia, and respiratory arrest. Treatment should begin with support of respiration. Atropine (2 mg) should be administered at intervals of 5 to 10 min until atropinization is achieved. Stomach and/or skin should be decontaminated. Pralidoxime chloride (15 mg/kg) is recommended as a supplement to atropine. Morphine, theophylline, or aminophylline should not be administered.

74-0074. Kaskevich, L. M.; Bezuglyy, V. P. (Inst. Hyg. Toxicol. Pestic., Polymers, Plastic Materials, Kiev, USSR). **Sostoyaniye zdorov'ya lits, rabotayushchikh s tetrametiltiuramdisul'fidom (TMTD) v usloviyakh kontrol'no-semennykh laboratoriy i semennykh zavodov. [The health status of subjects exposed occupationally to tetramethylthiuramdisulfide (TMTD) in seed control laboratories and seed dressing plants.]** *Gig. Tr. Prof. Zabol. 17(3): 49-51; 1973.* (11 references) (Russian)

The health of 162 females and 32 males, occupationally exposed to TMTD (thiram) concentrations of 0.03-3.2 mg/m^3 in seed control laboratories and seed dressing plants, was examined. Most of the subjects were between 20-50 years old; most of them had been occupationally exposed to pesticides from 1 to over 15 years. A high incidence of upper respiratory tract irritations, headache, fatigue, and epicardiac pains was noted. Cardiovascular system alterations occurred in 21.5% and hepatobiliary system alterations in 22% of all subjects. Liver damage was indicated by mild chronic hepatitis, often with disturbances in protein synthesis and in carbohydrate and urobilin excretion. Pathologic changes of the thyroid glands (hyperplasia and diffuse enlargement, and one case of malignant lesion) occurred in 7.5%. Prolonged contact with TMTD caused hematological changes which included moderate hypochromic anemia, leukopenia tendencies, and eosinopenia.

74-0075. Kolyada, I. S.; Mikhal'chenkova, O. F. (Regional Hospital, Cherkassy, USSR). **Ostraya intoksikatsiya khlorsoderzhashchimi yadokhimikatami. [Acute organochlorine pesticide poisoning.]** *Gig. Tr. Prof. Zabol. 17(5): 43; 1973.* (Russian)

Twenty 50-year-old women who worked for 1 to 1.5 hr in fields treated with high doses of DDT, polychloropinene, and hexachlorane (BHC) suffered acute poisoning five days later. Headache, dizziness, emesis, asthenia, pains in the legs, and motor disorders were the first symptoms of poisoning. Hyperemia and cyanosis of the face; hyperemia, edema and focal hemorrhages of the mucosa of the eye; extrasystole with slightly elevated arterial pressure; and analgesia of the limbs developed during hospitalization. Although the women generally improved by the second day of hospitalization, headache, dizziness, asthenia, pains in the limbs, and emesis persisted in most of the patients. Blood and urine tests did not reveal pathological changes. Toxic myocarditis developed in one case on the fifth day after poisoning; some patients developed polyneuritis 4 to 5 days after poisoning. All patients were discharged from the hospital between 6-7 days.

74-0076. Macdonald, E. J.; Lichtenstein, H.; Nooner, D.; Flory, D.; Wikstrom, S.; Oro, J. (Dept. Epidemiol., Univ. of Texas System Cancer Cent., M. D. Anderson Hosp. Tumor Inst., Houston, TX 77025). **Epidemiological factors in lung cancer among women in El Paso County, Texas 1944-1969.** *J. Amer. Med. Women's Ass. 28(9): 459-467; 1973.* (10 references)

DDT was present at levels of 5.8 and 0.4 ppm in 2 out of 4 samples of soot material, concomitantly analyzed for polynuclear aromatic hydrocarbons. The positive samples were scraped from the wall of one adobe house and the floor of another in which lung cancer patients lived. Unidentified polynuclear aromatic hydrocarbons were found in all samples from both houses. Residence from time of birth to adult life in an adobe house was one of the most significant factors in the etiology of lung cancer in women in El Paso County. The houses are poorly ventilated and usually heated by burning oil, wood, or other fuel in the center of the main room.

74-0077. Carson, E. D. (Dept. Ind. Forensic Sci., Belfast, N. Ireland). **Fatal paraquat poisoning in Northern Ireland.** *J. Forensic Sci. Soc. 12(3): 437-443; 1972.* (20 references)

Paraquat was detected by chemical analysis in seven out of nine cases of fatal paraquat poisoning observed over a 4-yr period. Survival varied from 36 hours to 15 days. When death did not occur until seven days after poisoning, paraquat was detected in only liver, kidney, and sketetal muscle. From the data obtained, it seems that elimination in man proceeds more slowly than in the rat, possibly because of paraquat storage in kidney, liver, and skeletal muscle.

74-0078. Oliver, J. S.; Smith, H.; Watson, A. A. (Dept. Forensic Med., Glasgow Univ., Glasgow G 12 8QQ, Scotland). **Sodium chlorate poisoning.** *J. Forensic Sci. Soc. 12(3): 445-448; 1972.* (3 references)

Autopsy findings of two suicides confirmed that death was a result of chlorate ingestion. In both cases death probably occurred within five hours of ingestion, and the weed killer was found among the effects of the deceased. The most characteristic finding on autopsy was a liquefied, chocolate-brown blood also found in many of the organs. Bladder scrapings and stomach contents gave positive reactions for oxidizing agents or chlorate in one case; urine contained 600 mg/100 ml chlorate in the other; organs and blood gave negative results. Incubated in vitro with chlorate, stomach contents and urine destroyed about 14% of the material, and other tissues destroyed up to 86%. The results indicate that analysis of urine and, provided that absorption has not been completed, stomach contents, is useful for diagnosis.

74-0079. Young, E.; Naude, T. (Vet. Investigation Cent., Skukuza, S. Africa). **Caution in the treatment of cheetahs with malathion.** *J. S. Afr. Vet. Ass. 44(2): 187; 1973.*

A Letter-to-the-Editor reports that cheetahs died after being immobilized with phencyclidine hydrochloride and bathed in a 5% malathion solution prepared from the emulsified form of the insecticide for the treatment of *Notoedres cati.* Although good results had been obtained in treating wild lions and cheetahs with malathion for mange, safety and compatibility data must be obtained. Until this is done, a 2.5% suspension of malathion wettable powder should be used.

74-0080. Parslow, J. L. F.; Jefferies, D. J.; Hanson, H. M. (Nature Conservancy, Monks Wood Exp. Station, Abbots Ripton, Huntingdon, England). **Gannet mortality incidents in 1972.** *Mar. Pollut. Bull. 4(3): 41-43; 1973.* (7 references)

The organochlorine and heavy metal residues were determined in gannets obtained from the east and west coasts of Britain where high mortality of these birds was recorded. Results showed that polychlorinated biphenyls may have contributed to the death of the Irish Sea gannets although they were probably not the primary cause. These birds had little fat and evinced signs of debilitation. Liver levels of polychlorinated biphenyls were quite high (4720 to 9570 ppm), and levels of DDE ranged from 260 to 520 ppm. Mercury may have contributed to the death of one of the birds examined, and dieldrin occurred in only three of the specimens. Birds collected from the Fife coast, on the other hand, appeared to have died suddenly. Studies uncovered lower liver levels of organochlorines than in the other birds and fat depots had not been mobilized. The precise cause of death was not established for these incidents of gannet mortality.

74-0081. Anonymous. **On chronic exposure to pesticides.** *Med. World News 14(33): 72E-72I; 1973.*

Present methods of monitoring exposure to pesticides are generally based on symptoms. Unfortunately, symptoms are a poor indicator of exposure since tolerances to limited doses develop and indicator symptoms disappear. A simple functional test based on electromyography (EMG) was developed to assess when pesticide exposure becomes harmful. The test was evaluated using persons exposed to organophosphates in the field, in the factory, and during therapy. Two adhesive electrodes were placed on the ulnar nerve and two on the adductor pollicis muscle of the thumb. The ulnar nerve was stimulated electrically and the muscle response recorded. Lower than normal voltage and repetitive firing were seen in electromyograms of exposed persons, even when AchE levels were normal. The EMG responses returned to normal several days after removal from exposure. More tests like this could improve the monitoring of the pesticide workers.

74-0082. Lawson, W. R. (Minnesota Dept. Health, Minneapolis, MN). **Parathion and other organophosphate pesticides. A medical emergency.** *Minn. Med. 56(4): 319-320; 1973.* (1 reference)

As organophosphates replace organochlorines, physicans should be prepared to diagnose and treat organophosphate poisoning which will assuredly become prevalent. All organophosphate pesticides inhibit ChE in man although their toxicities vary. However, a simple test for ChE activity, performed at no charge by the Minnesota Health Department, can detect overexposure in pesticide workers or confirm diagnosis of poisoning based on case history and symptoms. Abdominal pain, headache, nausea, weakness, diarrhea, vomiting, sweating, and pallor appear first; dyspnea, salivation, lacrimation, muscle twitching, convulsions, cyanosis, shock, cardiac arrhythmias, coma, and death often follow. Treatment may be as simple as removal from exposure or involve artificial respiration, atropine administration at doses 10 times higher those normally administered, and treatment with pralidoxime (within 24 hr of exposure).

74-0083. Anonymous. **'Paraquat' attacked.** *Nature (London) 245(5420): 64; 1973.*

Several drugs were put to novel use in a successful attempt to save an 11-yr-old boy severely poisoned by paraquat. An excretion rate of 5 μg/ml the third day after ingestion indicated a blood level of paraquat high enough to produce irreversible lung damage. Beclamethasone, a corticosteroid used in the treatment of asthma, was administered to help prevent the development of non-functional fibrous scar tissue in the lungs. D-propanolol was used as a possible competitor for paraquat on the membranes of the lung tissue where it binds. It was not possible to determine whether the effect was obtained. The rationale for the use of the third drug, Orgotein, was to break down hypothetical free radicals which might contribute to lung damage as shown by studies in plants where cells are damaged after paraquat is reduced by biological systems to free-radical oxygen. However, whether this happens in animal systems is dubious. The fact the child recovered in spite of having sustained some lung damage will probably stimulate research in the drugs used.

74-0084. Raake, W. (Inst. Pharmakol., Toxikol., Pharmazie, Tieraerztlichen Fakultaet, 8000 Munich 22, Germany). **Zur Wirkung von (2-Methyl-4-chlorophenoxy)-Essigsauere (MCPA) bei Rindern und Ratten. [Effect of (4-chloro-*o*-toloxy)acetic acid (MCPA) on cattle and rats.]** *Naunyn Schmiedebergs Arch. Pharmakol. 274: Suppl. R88; 1972.* (German)

A herd of 14 heifers, some of them pregnant, were poisoned with Banvel (34% MCPA; means of poisoning not described). The heifers (2-5 years old) developed a number of symptoms, which were generally resistant to therapy. Symptoms included salivation, anorexia, ataxia, muscular weakness, paralysis of hindquarters, bloody-mucous nasal effusion, pulmonary edema, bradycardia, gastrointestinal atony, hematuria, moaning, and progressive apathy. The recovery period was prolonged with the heifers generally unable to stand for 18 days. MCPA was detectable in the urine of the heifers for at least eight days after ingestion. Thin-layer chromatographic (methanol/benzene 5:95, bromophenol blue) and spectrophotometric (absorption maximum, 278 nm) detection of MCPA in the acidified ether fraction of the urine extract was not impaired by frozen storage of the urine. After oral administration of MCPA to rats, a shift of the MCPA spectrum to the left (absorption maximum at 272 nm) was observed and was attributed to a MCPA metabolite.

74-0085. Wadia, R. S.; Sadagopan, C. (Sassoon Gen. Hosp., Poona, India). **Organophosphates and pulmonary edema.** *N. Engl. J. Med. 289(2): 104; 1973.* (5 references)

A Letter-to-the-Editor notes that organophosphates are an important cause of pulmonary edema. Depression of ChE, after intoxication by these pesticides, leads to an accumulation of AChE and subsequent muscarinic and other effects. Pulmonary edema is the most important muscarinic effect and is responsible for almost all the early deaths in organophosphate poisoning. At autopsy, lungs are heavy and filled with fluid; the fluid can also be found in the alveoli in histologic sections. Organophosphates are the commonest cause of suicidal poisoning and of pulmonary edema in India.

74-0086. Clyne, R. M.; and Greenblatt, D. J.; Shader, R. I. (American Cyanamid Co., Wayne, NJ, and Mass. Gen. Hosp., Boston, MA). **Relative toxicity of malathion.** *N. Engl. J. Med. 289(11): 593; 1973.* (4 references)

A Letter-to-the-Editor refers to the listing of malathion in a table as a "deadly chemical toxin" along with nerve gases and other more toxic insecticides. It is argued that the wide toxicity range of these ChE inhibitors dictates separation of those which are weak inhibitors and useful compounds from those which are highly toxic. The reply notes that although malathion is less toxic to humans than parathion and diazinon, a number of poisonings and deaths have been attributed to the first-mentioned pesticide.

74-0087. Schoutens, A.; Dupuis, F.; Toussaint, C. (Radioisotope Div., Dept. Intern. Med., Brugmann Hosp., Brussels, Belgium). **^{131}I-Hippuran scanning in severe renal failure.** *Nephron 9: 275-290; 1972.* (8 references)

^{131}I-hippuran scanning was evaluated in seven cases of acute renal failure due to carbon tetrachloride or DDT and in cases of acute and terminal chronic renal failure due to other causes. All seven patients were oliguric, and five showed transient glucosuria. Six

patients recovered within one month; one, intoxicated by carbon tetrachloride, required dialysis 26 days after exposure and had elevated serum creatinine on day 42. Renal scans demonstrated a fairly homogeneous fixation of hippuran although the renal/perirenal activity ratio was below 6.5 in six cases. In patients with a kidney/tissue activity ratio over 10, serum creatinine concentration was lower than 2 mg/100 ml; in patients with creatinine levels over 2 mg/100 ml after two months the ratio never reached 7. The technique appears useful, but the entire clinical picture must be viewed since scans remained normal in obscure cases of renal failure.

74-0088. Hirayama, C. (Sch. of Med., Kyushu Univ., Fukuoka, Japan). **[Organochlorine poisoning—BHC and PCB.]** *Nippon Rinsho (Jap. J. Clin. Med.) 31(6): 2000-2007; 1973.* (47 references) (Japanese)

Gamma-BHC (lindane) is believed to cause many hematological diseases, especially refractory anemia. However, whether this is caused by BHC, or by an impurity in it, or by some other chemical absorbed simultaneously is not known. BHC induces ALA synthetase, P 450, aminopyrine demethylase, aldehyde oxidase, and excretion of porphyrin in mice and rats. Since metabolism may be accelerated by β-BHC-produced induction of the endoplasmic reticulum enzymes, irregularity in body functions (hormone metabolism disorder) could result from BHC poisoning. The chronic effects of BHC or PCB in the environment and accumulation of pollutants in the body are not known and cannot be until the relationship between concentration of these pollutants in blood and clinical symptoms is understood.

74-0089. Miyamoto, J. (Sumitomo Chem. Ind. Co. Ltd., Osaka, Japan). **[On the safety of pesticides.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(1): 9-26; 1973.* (7 references) (Japanese)

Effects of pesticides are considered in relation to persons who handle and apply pesticides, persons who do not use pesticides, and the environment. Those who work with pesticides must be protected from acute and subacute effects of the pesticide which can enter the body by ingestion, absorption through skin, and inhalation with resulting irritations to the skin and mucosa. Those not working with pesticides still suffer effects from consuming pesticide treated foods. Residues encompass problems which result gradually like transplacental transfer and hazards from mutagenicity, teratogenicity, and carcinogenicity. Additive toxicity from concomitant build-up or use of more than one pesticide can also result. Effects on the environment indirectly affect people and include toxicity to all living things and persistence and accumulation in everything in the environment, including soil and water, and build-up in the food chain. At least five more years and over a million dollars will be needed before solutions and safety measures are found.

74-0090. Bao, T. V.; Szabo, I. (Lab. Human Genetics, Nat. Inst. Pub. Health, Budapest, Hungary). **Kromoszoma-karosodasok heveny szerves foszforsav eszter (peszticid) mergezesekben. Elozetes kozlemeny. [Chromosome damage in acute phosphoric acid ester (pesticide) poisonings. Preliminary report.]** *Orv. Hetil. 113(43): 2593-2595; 1972.* (7 references) (Hungarian)

Chromosomal aberrations were studied in blood samples taken from 15 patients between the third and sixth day after acute poisoning with fosfothion (malathion), ditrifon, Phosdrine (mevinphos), methyl parathion, or Nuvan (dichlorvos). The frequency of chromosome counts diverging from 46 was 10.7% compared to a frequency of 5% in normal subjects. The percentage of stable chromosomal aberrations, which occurred in all but one patient, was 2.53%, as compared to 0.5% in the control group. Five cases of deletion, four cases of translocation, and another five cases of deletion with translocation were detected. Four cases of deletion were observed among the 10 control subjects. The increased frequency of stable aberrations is most probably due to an increase in deletions and reciprocal translocations. The significantly increased occurrence of chromosome breaks is indicative of the mutagenic effect of the organophosphorus pesticides.

74-0091. Blekherman, N. A.; Il'yina, V. I. (All Union Res. Inst. Hyg. and Toxicol. of Pestic., Polymers and Plastics, Kiev, USSR). **Deyaki zminy funktsii yayechnikiv u zhinok, yaki perebuvayut'v kontakti z khlororhanichnymy spolukamy. [Changes in ovary function in women in contact with organochlorine compounds.]** *Pediatriya 52: 57-59; 1973.* (Ukrainian)

Ovary function was studied in 30 women by measuring basal temperature and estrogen and pregnanediol levels in the urine and performing cytological studies on vaginal smears. The women were between 21 and 50 years old and had been occupationally exposed to organochlorines for 1-10 years. A high level of estrogen (191 ± 15.8 μg/sample) and the presence of pregnanediol (0.28 ± 0.09 μg/sample) were noted by the 7th day of the menstrual cycle. The estrogen level remained fairly constant during the menstrual cycle with no distinct ovulation or luteinizing hormone peaks. Estrogen secretion decreased slightly during corpus luteum function. No increases in estrogen or pregnanediol levels were noted in menopausal women. No cytological differences were detected. A study of basal temperature showed the shortening of the hyperthermic phase to 10 days and an increase of 0.3-0.4°C in basal temperature after ov lation. Determination of estrogen level was considered the most sensitive test of ovary function.

74-0092. Muirhead-Thomson, R. C. (Author address not given). **Pesticides and freshwater fauna.** *Academic Press Inc., London-New York, 1971, 248 p.* (400 references)

The object of the survey represented by this book is not simply to record or summarize the data on pesticide effects on freshwater animal life published in recent years, but rather to focus on the techniques employed in gathering the facts. Because of the wide range of specialists interested in different facets of this problem, evaluation techniques and standards tend to be equally diverse and to have developed independently of each other. Chapters deal with piscicides (chemical control of undesirable fish); chemical control of freshwater snails in public health; insects of public health importance (evaluation of chemical control directed against aquatic stages); impact of pesticides on aquatic invertebrates in nature; and influence of chemical and physical factors on pesticide impact in fresh water. Findings on organochlorine contamination of Canadian salmon streams and on sea lamprey control, some from unpublished reports, are included.

74-0093. Komoto, M.; Kikuchi, N.; Fukami, Y. (Sch. Ophthalmol., Fac. Med., Toho Univ., Tokyo, Japan). **[Cases of apparent pesticide poisoning accompanied by myopathy.]** *Rinsho Ganka (Jap. J. Clin. Ophthalmol.) 27(6): 751-755; 1973.* (16 references) (Japanese)

Systemic myopathy and myasthenia gravis developed in a 22-year-old man and his 47-year-old mother, both agricultural workers. Mother and son were repeatedly exposed to EPN, malathion, and Kitazin while working in paddy fields, and to EPN, thiophanate, polyoxin, sulfur fumigant, and other organic pesticides while working in a plastic greenhouse for the past six years. Both had apparently pathological decreases in serum and erythrocyte ChE activities and abnormally high serum creatine phosphokinase values, 127 units and 49.8 units in mother and son, respectively. Macular or punctiliform scattered opacities were present in the cortex of the lens and in the iridal pigment deposited on the anterior surface of the lens capsule of the son. Both of his fundi displayed clear, fringed, annular abnormalities around the macula lutea. No lenticular opacities were present in the mother's eyes, but an abnormal black pigment was deposited in the fundus around the macula lutea, along with retinochoroid atrophy, indications of healed chorioretinitis, and slight atrophy of the optic nerve. Refractive power, cornea, and pupil seemed normal. Etiologic considerations first focused on a possible hereditary factor, but an environmental factor, such as organophosphate poisoning, may have played a role.

74-0094. DeLong, R. L.; Gilmartin, W. G.; Simpson, J. G. (Marine Mammal Div., Nat. Marine Fish. Serv., Seattle, WA 98115). **Premature births in California sea lions: association with high organochlorine pollutant residue levels.** *Science 181(4105): 1168-1170; 1973.* (19 references)

Premature pupping in California sea lions has been noted on the breeding islands since 1968. The quantitative incidence of this condition has not been established. Two groups of postpartum female California sea lions and their pups were collected within 24 hours after parturition on San Miguel island in April (premature) and June (full-term), 1970. Liver, brain, and blubber were analyzed for DDT compounds, dieldrin, and polychlorinated biphenyls using GLC. Dieldrin was found infrequently. The most prevalent metabolite was DDE, accounting for 80-90% of the total DDT. Tissues from females which gave birth prematurely in 1970 contained higher organochlorine concentrations than tissues from females which gave birth to full-term pups. Total DDT in blubber of the former averaged 824.4 ppm, and of the latter, 103.2 ppm. The brains of premature pups contained twice the organochlorine concentrations in the brains of full-term pups. PCB levels in blubber, liver, and brains of the premature parturient group were 6.6, 4.4, and 2.4 times higher than in the normals. In neither blubber nor liver did the ranges of residue values of total DDT or PCB in premature and full-term groups overlap. Some other factors possibly capable of causing premature births were excluded, e.g., brucellosis and leptospirosis.

See also 74-0034 74-0040 74-0057 74-0066 74-0068 74-0080 74-0139 74-0141 74-0173

74-0095. Hanker, I.; Taimr, L. (Radiobiol. Lab., Inst. Plant Protection, Ke dvoru 16, 166 30 Praha 6, Vokovice, Czechoslovakia). **Penetration, excretion and metabolism of DDT-^{14}C in susceptible and resistant populations of the Colorado potato beetle, *Leptinotarsa decemlineata* Say.** *Acta Entomol. Bohemoslov. 70(3): 174-188; 1973.* (24 references)

The primary mechanism of resistance of the Colorado potato beetle is its ability to metabolize DDT to DDE. Field studies have shown that degree of resistance is proportional to metabolizing ability. Both susceptible and resistant beetles excreted DDT unchanged; however, within 48 hr 19 to 46% of the DDT present in resistant beetles was converted to non-toxic DDE, compared to 0 to 2.4% in susceptible beetles. Some of the resistant beetles were capable of neutralizing intoxication within 5 to 8 days. Penetration and excretion of ^{14} C-DDT in two susceptible and three resistant strains were not significantly different although a more rapid rate of excretion appeared to be responsible for differences in susceptibility within a population.

74-0096. Ramisz, A.; Szankowska, Z.; Spaldonowa, R. (Lab. Vet. Hygiene, Krakow, Brodowicza 13a, Poland). **A histochemical study of the effect of phosphoroorganic esters on the cholinesterase activity in the course of experimental trichinellosis in mice. I. The effect of Maretin, Neguvon, and Eustidil on the muscle phase of trichinellosiss.** *Acta Parasitol. Pol. 19(37): 407-416; 1971.* (18 references)

Control mice and mice previously infected with *Trichinella* exhibited strongest symptoms of organophosphate intoxication 13-19 days after treatment with Maretin (phosmet) (50 mg/kg), Neguvon (trichlorfon) (3 mg/mouse), or Eustidil (50 mg/kg). Maretin was the most toxic, producing respiration disorders, the characteristic yawn, diarrhea, tonic-clonic spasms of skeletal muscles, tail stiffness, and death. AChE activity was totally inhibited by Maretin in muscle fibers into which *Trichinella* larvae had penetrated, and 70 to 80% inhibited in motor end-plates. Pseudo ChE was even more strongly inhibited by administration of Maretin. Neguvon inhibited the enzymes to a lesser degree, and no inhibition was observed with Eustidil in muscles into which larvae had penetrated or in motor end-plates.

74-0097. Hagstrom, B. E.; Lonning, S. (Author address not given). **The sea urchin egg as a testing object in toxicology.** *Acta Pharmacol. Toxicol. 32(Suppl. 1): 1-49; 1973.* (29 references)

During the development of the sea urchin egg, extensively studied because of its resemblance to that of the human ovum, chloramphenicol exposure (at concentrations of $10^{-6}M$ or more) leads to decreased rate of cleavage and suppressed ciliation and hatching. Treatment at $10^{-6}M$ for three hours before or after hatching resulted in immigration of the primary mesenchyme and the invagination of the gut. After exposure at that time or during the cleavage stage, disturbances of the skeleton were observed in the pluteus stage. The effects were observed at lower concentrations when treatment was continued over a longer period of time. Nicotine, applied during the cleavage stages at concentrations of 10^{-5} and $10^{-6}M$, generally completely inhibited development beyond the blastula stage. When added after hatching, nicotine prevented differentiation of intestine and skeleton. Cytological studies indicated that nicotine affects the spindle and the movements of the chromosomes.

74-0098. Iwanow, E.; Hlebarowa, M.; Krustev, L.; Dimitrov, P.; Orbetzova, V.; Nenov, P.; Kirjakov, A.; Tsontscheva, A. (Inst. f. Ernaehrungsforschung, Bulgarische Akademie der Wissenschaften, Sofia, Bulgaria). **Biochemische und histomorphologische Veraenderungen bei der experimentell durch Hexachlorbenzol hervorgerufenen Porphyrie. [Biochemical and histomorphological changes in experimental hexachlorobenzene porphyria.]** *Acta Hepato-Gastroenterol. 20(1): 39-48; 1973.* (46 references) (German)

Daily hexachlorobenzene doses of 0.4 g/100 g body weight produced a model of liver porphyria in male Wistar rats. The histomorphological liver changes included moderate dystrophy which contrasted with the severe clinical picture of the intoxication. Hyperemia, moderate lymphocytic and histiocytic infiltration in the portal fields, venous stasis, moderate dystrophy of the hepatocytes, and moderate proliferation of the reticular fibers in the portal fields were observed in the liver 3 to 15 days after the poisoning was started. The LDH and MDH activities decreased while the alkaline phosphatase activity increased. The serum enzyme activities showed no essential changes. The rate of excretion of porphyrins and their precursors in urine and feces reached its highest level on the 11th day, and dropped to about the 15th day. Marked decreases in NAD and $NADH_2$ values, lowering of the pyruvate levels and of ATP and AMP, increase in ADP, and absence of changes in lactate and alpha-ketoglutarate were demonstrated in the liver. Intensification of most parameters 30 days after stoppage of the poisoning was noted. Hexachlorobenzene is presumed to cause direct toxic injury of the liver as a result of pathologic changes in the regulatory mechanism.

74-0099. Calabrese, A. (U. S. Dept. Commerce, Nat. Mar. Fish. Serv., Biol. Lab., Milford, CT). **Effects of some pollutants on embryos and larvae of the American oyster and hard shell clam.** *Amer. Chem. Soc., Div. Water, Air Waste Chem., Gen. Pap. 11(2): 64-75; 1971.*

During an investigation of the effects of several kinds of pollutants on embryonic development and growth and survival of larvae of the hard shell clam and the American oyster, 48 pesticides and 4 solvents used in

formulation were tested. Embryonic development was affected more than survival and growth of larvae by most of the compounds, but growth was drastically reduced by some compounds at concentrations that had little effect on the embryos. Great differences in sensitivity to compounds within each group were observed. At 0.05 ppm, DDT caused over 90% mortality of oyster larvae and almost completely inhibited growth while 5.0 ppm lindane stimulated growth of clam larvae.

74-0100. Sides, P. J.; Finn, A. L.; (Duke Univ. Sch. Med., Durham, NC). **Effects of 2,2-bis(*p*-chlorophenyl)-1,1,1-trichloroethane (DDT) on sodium transport in toad bladder.** *Amer. J. Pathol. 70(2): 58a-59a; 1973.*

Bladders of Dominican toads, but rarely those of Columbian toads, exposed to 35 ppm DDT for 1-3 hr exhibited a small increase in short-circuit current (SCC). After 20 hr exposure the SCC had decreased to very low levels in both species, and a moderate reduction in transepithelial resistance was noted. Oxygen consumption was low; potassium decreased and sodium and chloride increased intracellularly. The net sodium flux and the SCC showed a correlation in both the early stimulated and late depressed phases; no large increase in backflux was observed until the SCC approached zero. The results suggest that changes in SCC induced by DDT are due to net changes in sodium transport and not to an effect on sodium permeability. Possible modes of action include a direct effect on the sodium pump mechanism or an indirect effect via oxidative metabolism.

74-0101. Mackenzie, K. A.; MacRae, I. C. (Egg Marketing Board, Brisbane, Queensland, Australia). **Tolerance of the nitrogen-fixing system of *Azotobacter vinelandii* for four commonly used pesticides.** *Antonie van Leeuwenhoek J. Microbiol. Serol. 38(4): 529-535; 1972.* (11 references)

DDT, lindane, 2,4,5,-T, and dalapon at concentrations equivalent to and 50 times greater than the normal field application rates did not cause significant changes in specific growth rate or acetylene reduction in *Azotobacter vinelandii* in mannitol nitrogen-free medium. During the experiment DDT and lindane were evenly distributed throughout the medium through the use of Tween 80, acetone, and sonication. The results indicate that this microorganism is not likely to be affected by the four pesticides in soil.

74-0102. Johnson, B. T.; Kennedy, J. O. (Fish-Pestic. Res. Lab., Bur. Sport Fish. Wildl., U. S. Dept. Int., Columbia, MO 65201). **Biomagnification of *p,p'*-DDT and methoxychlor by bacteria.** *Appl. Microbiol. 26(1): 66-71; 1973.* (19 references)

Aerobacter aerogenes and *Bacillus subtilis* accumulated *p,p'*-DDT and methoxychlor directly from water. Uptake of both ^{14}C-labeled organochlorine insecticides was rapid; 80 to 90% of the 24-hr residues were reached within 30 min. Total cellular residues varied linearly with concentrations of DDT and methoxychlor in water ranging from 0.5 to 5.0 μg/liter. The residue magnification factors from water were between 1,400- to 4,300-fold, but were independent of insecticide concentrations in water. When the insecticide-exposed microbial cells were washed with pesticide-free water, DDT residues were 45% in *A. aerogenes* and 30% in *B. subtilis*, whereas the methoxychlor level decreased nearly 75% in both organisms. Subsequent washing did not further reduce the insecticide residue. Autoclave-killed bacteria also rapidly adsorbed DDT and methoxychlor from water and, in some instances, residues were higher than in the living cells. Molecular polarity and lipid solubility appear to influence the retention of the organochlorine insecticides by bacterial cells. (Author abstract by permission)

74-0103. Nelson, J. D.; Blair, W.; Brinckman, F. E.; Colwell, R. R.; Iverson, W. P. (Dept. of Microbiol., Univ. of Maryland, College Park, MD 20742). **Biodegradation of phenylmercuric acetate by mercury-resistant bacteria.** *Appl. Microbiol. 26(3): 321-326; 1973.* (19 references)

Selected cultures of mercury-resistant bacteria degrade the fungicide-slimicide phenylmercuric acetate. By means of a closed system incorporating a flameless atomic absorption spectrophotometer and a vapor phase chromatograph, it was demonstrated that elemental mercury vapor and benzene were products of phenylmercuric acetate degradation. (Author abstract by permission)

74-0104. Sharpee, K. W.; Duxbury, J. M.; Alexander, M. (Lab. of Soil Microbiol., Dept. of Agron., Cornell Univ., Ithaca, NY 14850). **2,4-Dichlorophenoxyacetate metabolism by *Arthrobacter* sp.: Accumulation of a chlorobutenolide.** *Appl. Microbiol. 26(3): 445-447; 1973.* (19 references)

An enzyme preparation from 2,4-dichlorophenoxyacetate-grown *Arthrobacter* sp. converted *cis. cis*-2,4,-dichloromuconate to chloromaleylacetate. The enzyme lactonizing the dichloromuconate to yield 2-chloro-4-carboxymethylene but-2-enolide was separated from the butenolide-delactonizing enzyme. (Author abstract by permission)

74-0105. Janda, J. (Vyzkumny ustav lesniho hospodarstvi a myslivosti, Zbraslav n. Vltavou, Czechoslovakia). **Nebezpeci raticidnich pripravku s fosfidem zinku pro lovnou zver. [The danger to wildlife of raticides containing zinc phosphide.]** *Agrochemia 13(3): 84-86; 1973.* (7 references) (Czech)

The palatability and attractiveness of three raticides to pheasants, hares, and partridges was compared in experiments where the preparations were offered to

fasting individuals. Nera grains, a Czechoslovak preparation consisting of red-colored wheat grains containing 2.5% zinc phosphide; M-Koeder klein, a preparation of West German origin consisting of oblong platelets with 1.4% zinc phosphide; and Arrex-E, another West German preparation consisting of sunflower seeds coated with a paste and containing 3.8% zinc were tested. Of the 3 preparations only Arrex-E is suitable as a raticide bait for use in the open field because it was generally untouched even by hungry animals. The other 2 preparations were picked up and eaten after a time in spite of their unnatural color; color is not a deterrent for any length of time, as wildlife will eventually become accustomed even to gold and silver. If Nera grains are used they must be pushed deep into the tunnels of mice and other field pests so as not to poison wildlife.

74-0106. Simeon, V.; Reiner, E.; Vernon, C. A. (Inst. Med. Res., Yugoslav Acad. Sci. Arts, Zagreb, Croatia, Yugoslavia). **Effect of temperature and pH on carbamoylation and phosphorylation of serum cholinesterases.** *Biochem. J. 130(2): 515-524; 1972.* (15 references)

Monomethylcarbamates, dimethylcarbamates, and organophosphates, tested at various temperatures and pHs for inhibition of horse serum and human serum ChE, yielded results characteristic of a bimolecular reaction with the inhibitor in excess and the concentrations of the Michaelis complex negligibly small. Rate constants increased with pH and reached a maximum at about pH 9.5. With all compounds the increase followed a theoretical curve for the dissociation of a single group on the enzyme with $pK_1 = 7.5$. The second order rate constants of inhibition of horse serum ChE increased with temperature up to 30° and decreased between 30° and 40°. Rate constants increased with temperature; with human serum ChE the increase followed the Arrhenius law. The unusual effect of temperature on horse serum ChE could be due to the establishment of equilibrium between intermediate enzyme-inhibitor complex and reactants or to the fact that a large entropy change occurs on the formation of the intermediate associated with changes in solvation produced by a conformation change in the protein.

74-0107. Catelani, D.; Colombi, A.; Sorlini, C.; Treccani, V. (Inst. Agrarian Tech. Microbiol., Univ. Milan, 20133 Milan, Italy). **Metabolism of biphenyl. 2-Hydroxy-6-oxo-6-phenylhexa-2,4-dienoate: the *meta*-cleavage product from 2,3-dihydroxybiphenyl by *Pseudomonas putida*.** *Biochem. J. 134(4): 1063-1066; 1973.* (14 references)

Pseudomonas putida converted 2,3-dihydroxybiphenyl to benzoic acid and a product which was probably 2-hydroxy-6-oxo-6-phenylhexa-2,4-dienoic acid via an α-hydroxymuconic semialdehyde. Crude cell-free extracts of *Ps. putida* rapidly oxidized 2,3-dihydroxybiphenyl with an oxygen uptake of 1 mol/mol of substrate, and oxygen uptake was not observed when 2-hydroxy-6-oxo-phenylhexa-2,4-dienoate was incubated with these extracts. The proposed pathway of biphenyl degradation by *Ps. putida* includes the following compounds: 2,3-dihydro-2,3-dihydroxybiphenyl; 2,3-dihydroxybiphenyl; 2-hydroxy-6-oxo-6-phenylhexa-2,4-dienoic acid; 2-hydroxypenta-2,4-dienoic acid; 4-hydroxy-2-oxovaleric acid.

74-0108. Renzoni, A. (Ist. Anat. Comp., Univ. Siena, Via delle Cerchia 3, 53100 Siena, Italy). **The influence of some toxicants on the reproductive activities of the Japanese quail (*Coturnix coturnix japonica*).** *Biol. Conserv. 5(3): 181-184; 1973.* (20 references)

Exposure to drinking water containing ABS-type detergent, LAS-type detergent, Herbicide extra (36.5% 2,4-D), or Zeazin S (triazine and simazine) at 1 ppt did not affect body weight of young Japanese quail in a 10-wk study. Exposure of quail aged 3-16 weeks retarded the average day of the first egg laid, slightly reduced the total number of eggs produced, and markedly reduced the fertility index in the case of 2,4-D or LAS-type detergent. A reversible effect on all three parameters was observed when birds were exposed to 10 ppt of a mixture of the four materials.

74-0109. Gruppuso, P. A.; Kinter, L. B. (Dept. Biol. Sci., Union College, Schenectady, NY 12308). **DDT inhibition of active chlorophenol red transport in goldfish (*Carassius auratus*) renal tubules.** *Bull. Environ. Contam. Toxicol. 10(3): 181-186; 1973.* (15 references)

DDT and some of its metabolites inhibited concentration of chlorophenol red in the luminal fluid of goldfish kidney tubules. The method used to study this effect was a visual rating procedure in which teased masses of tubules were placed in depressions of a ceramic-ring slide, exposed to medium containing the dye and test compound, and viewed under a compound microscope. A least squares curve-fitting computer program was used to give dye uptake curves. Exposure to DDT for 90 min at $10^{-3}M$, $10^{-4}M$ and $10^{-5}M$ resulted in 71%, 31%, and 23% inhibition of active chlorophenol red transport, respectively. Inhibition at $10^{-4}M$ was 29% with TDE, 49% with DDE, and 52% (60 min) with DDA. Known inhibitors gave responses similar to those previously published. Increased permeability of membrane junctions between tubular cells, decreased oxidative phosphorylation in the mitochondria, or decreased sodium pump activity in the tubular cells may be responsible for this and other membrane effects of DDT-like compounds.

74-0110. Grosch, D. S. (Genetics Dept., N. Carolina State Univ., Raleigh, NC 27607). **Reproduction tests: the toxicity for *Artemia* of derivatives fron non-persistent pesticides.** *Biol. Bull. 145(2): 340-351; 1973.* (24 references)

In mating pair tests, life span of brine shrimp decreased after treatment at 10 ppm for 24 hrs with *p*-nitrophenol, 2-isopropyl-4-methyl-*o*-hydroxy pyrimidine, 1,5-dihydroxynaphthalene, 1-naphthol, 1-naphthyl hydroxymethyl carbamate, or 1,3,5-trichlorobenzene, which are degradation products of some non-persistent pesticides. Average total number of broods per pair was decreased by each test compound. With some of the compounds the decrease in number of broods was due entirely to the decrease in life span or to a delay in appearance of the first brood, while with others a decrease in the number of zygotes per brood was observed. Lowered larvae survival was noted with 1,5-dihydroxy naphthalene, 1-naphthyl hydroxymethyl carbamate or 1,3,5-trichlorobenzene. Appreciable improvement in reproductive success was observed in mating pair tests with shrimp taken from populations exposed for 1 yr. at 10 ppm to each nonlethal pesticide derivative. The presence of live larvae or viable cysts was apparently more important to survival of the population than an adequate "standing crop" of adults.

74-0111. Savateyev, N. V.; Tonkopiy, V. D.; Brestkina, L. M.; Gromov, A. Ye. (S. M. Kirov Acad. Military Med. Leningrad, USSR). **Analiz mekhanizma lechebnogo deystviya kisloroda pod davleniyem pri otravleniyakh fosfororganicheskimi soyedineniyami. [Analysis of the mechanism of the therapeutic action of oxygen under pressure in organic phosphorus poisoning.]** *Byull. Eksp. Biol. Med. 75(3): 51-53; 1973.* (11 references) (Russian)

The mechanism of the therapeutic action of pressurized oxygen was studied in rabbits after i.m. administration of 0.25 or 0.5 mg/kg of paraoxon. Acute poisoning with lethal doses of paraoxon led to a fall in the oxygen partial pressure in muscles and venous blood and to a shift in the acid-base balance leading to uncompensated metabolic and respiratory acidosis. A considerable increase in the survival time was achieved: from about 15 min in a control group to 1.5-2 hr in the group poisoned with 0.5 mg of paraoxon per kg; from 28 min in another control group to 1.5-3 hr in the group poisoned with 0.25 mg of paraoxon per kg. Partial compensation of hypoxia without any normalization of the acid-base balance was noted in the test group transferred into a chamber under 3 atm oxygen pressure immediately after poisoning. Convulsions and coma occurred in the group treated with pressurized oxygen, and death occurred in these animals as well as in the control group poisoned with a lethal dose of paraoxon.

74-0112. Ahmed, M.; Grant, W. F. (Genetics Lab., MacDonald Campus of McGill Univ., Ste. Anne de Bellevue, Quebec, Canada). **Cytological effects of the pesticides Phosdrin (mevinphos) and Bladex on *Tradescantia* and *Vicia faba*.** *Can. J. Genet. Cytol. 14: 157-165; 1972.* (17 references)

The frequency of chromosomal aberrations was significantly higher in root tips of *Tradescantia* and *Vicia faba* treated with Phosdrin (mevinphos) or Bladex (cyanazine) at concentrations of 200, 400, and 600 ppm for three or six hours than in root tips of control plants. Both compounds produced the same kinds of abnormalities as the chemical mutagen, ethyl methane sulfonate (EMS), including fragments, bridges, multipolar anaphases, and lagging chromosomes. Bladex produced a higher percentage (3.47%) of aberrations in *Tradescantia* than Phosdrin (2.56%) and a lower percentage in *Vicia faba* than EMS or Phosdrin. The latter effect was probably due to the fact that Bladex was extremely toxic to the cells. In meiotic studies spraying with Bladex was lethal to the plants, and spraying with Phosdrin induced irregularities which included extreme stickiness, fragments, bridges, and unequal and asynchronous division of chromosomes at anaphase II.

74-0113. Mohandas, T.; Grant, W. F. (Genetics Lab., MacDonald Campus of McGill Univ., Ste. Anne de Bellevue, Quebec, Canada). **Cytogenetic effects of 2,4-D and amitrole in relation to nuclear volume and DNA content in some higher plants.** *Can. J. Genet. Cytol. 14: 773-783; 1972.* (20 references)

Amitrole and 2,4-D induced chromosome bridges, fragments, lagging chromosomes, and chromatin bodies; 2,4-D induced chromosome contraction and C-mitoses in a number of species of weeds and cultivated plants. Levels as low as 50 ppm 2,4-D or 100 ppm amitrole applied as Estasol 128 or Cytrol, respectively, significantly increased the frequency of chromosome aberrations in root tips of some species. Both 2,4-D and the positive control, ethyl methane sulfonate (EMS), produced *albina* mutants after seed treatments of *Hordeum vulgare* on M_2 seedlings. No clear relationship was observed between the number of cytological abnormalities induced by the herbicides and the nuclear and interphase chromosome volumes of the plants.

74-0114. Kohli, J.; Weisgerber, I.; Klein, W.; Korte, F. (Inst. Oekol. Chem., Gesellsch. Strahlen- Umweltforsch. mbH, Munich, Germany). **Beitraege zur oekologischen Chemie LIX. Rueckstaendsverhalten und Umwandlung von Dieldrin-^{14}C in Kulturpflanzen, Boden und Sickerwasser nach Bodenapplikation. [Contributions to ecological chemistry, Part 59. Residue behavior and transformation of dieldrin-^{14}C in crops, soils, and leachate after soil application.]** *Chemosphere 2(4): 153-156; 1973.* (11 references) (German)

Model experiments on dieldrin degradation were performed using the experimental setup previously

described (see Abstract no. 74-0030). The uppermost soil layer (to 10 cm deep) contained 0.521 ppm dieldrin-^{14}C and 0.008 ppm dieldrin-^{14}C transformation products from the previous year's treatment; another 0.83 kg/ha of dieldrin-^{14}C was added and worked in to a depth of 10 cm. Radioactivity was not detectable (< 0.001 ppm) in the leachate collected from the bottom of the test box (60 cm depth). After extraction and concentration radioactive products in the leachate of the first year averaged 0.5 ppb and 0.3 ppb in that of the second year. A total of 0.16% of the applied radioactivity was washed out by the water. It consisted almost entirely of dihydrochlordene dicarboxylic acid. This dieldrin oxidation product was presumably formed in the plant/soil system in view of the abundance of plant oxidases. The residues in the soil and in the beets planted during the second year of the experiment as well as the kohlrabi planted during the first year consisted mainly of unchanged dieldrin. Some photodieldrin was found along with small quantities of a group of hydrophilic metabolites which could not be identified. The peeled kohlrabi contained 0.006 ppm dieldrin, 0.001 ppm photodieldrin, and 0.003 ppm hydrophilic metabolites; beets contained 0.125 ppm dieldrin, 0.005 ppm photodieldrin, and 0.002 ppm hydrophilic metabolites.

74-0115. Nagasaki, H.; Arai, M.; Makiura, S.; Sugihara, S.; Hirao, K.; Matsumura, K.; Ito, N. (Sch. Hyg., Nara Med. Coll., Nara, Japan). **[Studies on interactions of BHC isomers and PCBs in the induction of liver tumors in the mouse.]** *Collected Lecture Abstracts, United Societies of Cancer in Japan, October 1973, p 160.* (Japanese)

Feeding experiments were performed in mice. The first test was done on groups of 260 dd-strain male and female mice. Individual BHC isomers, α-, γ-, β-, and δ-BHC, were added to basic diet at 500, 250, and 100 ppm; these diets were fed to mice for 24 weeks. In the second test series, using 280 dd-strain male mice, each of the pairs of the BHC isomers was mixed with basic diet at 250 mm and the diet fed to mice for 24 weeks. The control groups for this experiment were given diets containing BHC isomers singly. In the third test series diets containing 50-250 ppm of single BHC isomers were further spiked with 250 ppm of a PCB, KC-500 (mostly pentachlorobiphenyl) and administered to 580 mice for 24 weeks. Differences in tumorigenesis according to gender were found at 100 ppm of α-BHC; the lower frequency occurred in females. No significant difference in frequency of tumorigenesis was found for any pair of the four BHC isomers. Addition of KC-500 at 250 ppm induced tumorigenesis in the groups at 50 or 100 ppm α-BHC and 100 or 250 ppm of β-BHC although these levels of KC-500, α-BHC, and β-BHC alone did not induce tumor development. (Lecture no. 313, presented at the combined 32nd Annual Meeting of the Japan Society of Cancer, 11th annual meeting of the Japan Society of Cancer Therapy, and 14th annual meeting of the Japan Society of Lung Cancer.)

74-0116. Bradbury, S. J. (Dept. of Biol. Sci., Univ. of Lancaster, Bailrigg, Lancaster, England). **The effect of parathion on crustacean skeletal muscle—I. The mechanical threshold and dependence on Ca^{2+} ions.** *Comp. Biochem. Physiol. 44A(4): 1021-1032; 1973.* (23 references)

The threshold for potassium-induced contractures in *Carcinus* skeletal muscle is 70 m*M*, tension being maximal above 100 m*M* KCl. Parathion, at a concentration of 0.5 m*M*, induced irreversible tonic contractures, these contractures being enhanced to well beyond peak tetanus tension by increasing external K^+. In parathion-containing salines the mechanical threshold of the muscle fibers was considerably lowered, but unlike the caffeine effect tension was always generated, even at low K^+ levels. The parathion/K^+ contractures were reduced at low and at very high Ca^{2+} levels, although measurable tension was still developed in zero Ca^{2+} salines. Potassium-induced contractures were abolished at low Ca^{2+} levels but were not reduced at very high Ca^{2+} levels. Parathion does not appear to activate muscle by a transient depolarization, and although it modifies the mechanical threshold, its major action appears to be on the internal calcium control system of the muscle fiber. (Author abstract by permission)

74-0117. Bradbury, S. J. (Dept. Biol. Sci., Univ. Lancaster, Bailrigg, Lancaster, England). **The effect of parathion on crustacean skeletal muscle—II. Disruption of excitation-contraction coupling.** *Comp. Biochem. Physiol. 44A(4): 1033-1046; 1973.* (30 references)

Parathion induces tonic contractures in crab skeletal muscle. These contractures are irreversible at concentrations greater than about 100 μM. The contracture-induction effect was examined in terms of disruption of the electromechanical coupling process at a number of possible stages: (a) membrane depolarization, (b) the reticular calcium control system, (c) actomyosin cross bridge formation, and (d) structural changes in the fibers. It has been established that parathion does not activate muscle by a transient depolarization, but it does significantly depress reticular calcium uptake. In addition, parathion greatly modifies actomyosin superprecipitation, and fine-structural studies show great disruption of reticular organization, suggestive of massive calcium loss from the reticulum into the myoplasm. (Author abstract by permission)

74-0118. Bush, F. M.; Price, J. R.; Townsend, J. I. (Dept. Anat., Program Hum. Genet., Med. Coll. Virginia, Health Sci. Div., Virginia Commonwealth Univ., Richmond, VA 23219). **Avian hepatic esterases, pesticides and diet.** *Comp. Biochem. Physiol. 44B(4): 1137-1151; 1973.* (41 references)

Manometric assays of liver esterase activity in fifty-five species of birds disclosed homogeneous levels in four orders and heterogeneous levels in two, as well as different rates of hydrolysis of different substrates within species. Some correlations were detected between the size or diet of a species and the level of its hepatic esterase activity on phenyl acetate, triacetin and choline esters. Correlations were detected between the diet and the amount of hepatic esterase inhibition on triacetin by parathion, carbaryl, and dichlorvos. (Author abstract by permission)

74-0119. Krampitz, G.; Hardebeck, H. (Inst. Anat. Physiol. Haustiere, Lehrbereich Biochem., Univ. Bonn, Germany). **Ueber den Einfluss von polychlorierten Kohlenwasserstoffen auf den Stoffwechsel von Warmbluetern. III. Mitteilung: Ueber den Einfluss von polychlorierten Insektiziden auf Enzym- und Hormonsysteme von Saeugetieren und Voegeln. [Effects of polychlorinated hydrocarbons on the metabolism of warm-blooded animals. Part 3. Effects of polychlorinated insecticides on enzyme and hormone systems in mammals and birds.]** *Deut. Tieraerztl. Wochenschr. 80(5): 108-112; 1973.* (55 references) (German)

Effects of organochlorine insecticides on metabolic conversion of other materials, endogenous and exogenous, are reviewed. Induction of mixed-function oxidases, especially in liver, by organochlorines is well known and accounts for the increased degradation rates of some drugs seen after organochlorine exposure. DDT and its analogs inhibit other enzymes. Carbonic anhydrase, which is necessary for the formation of eggshell, is inhibited indirectly via estrogen inactivation. The goitrogenic effects of *o,p'*-DDD (TDE) are caused by increases in thyroxine metabolism in the liver. Activities of migratory birds are primarily regulated by hormonal mechanisms; polychlorinated biphenyls may disturb these activities. The estrogenic effects of DDT isomers are expressed in precocious puberty, peristent estrus, ovarian follicular cysts, reduction of corpora lutea, and disturbances of mating behavior in mammals. In birds, estrogenic effects may affect reproduction so severely as to threaten preservation of the species. Paradoxically, DDT induces estrogen-inactivating enzymes while itself displaying estrogenic activity. Advantageous effects of DDT include its promotion of organophosphate detoxication and bilirubin metabolism.

74-0120. Walker, W. W. (Mississippi State Univ., State College, MS). **Degradation of malathion by indigenous soil microorganisms.** *Diss. Abstr. Int. 33(4): 1347B; 1972.*

Degradation of malathion by five soil bacteria was demonstrated. One of these, an *Arthrobacter* species, readily degraded malathion in vitro to malathion half-ester, malathion dicarboxylic acid, potassium dimethyl phosphorodithioate, potassium dimethyl phosphorothioate, and an unidentified metabolite. *O*-demethyl malathion, potassium salt, was produced by a nonbiological mechanism. Metabolites were tentatively identified by thin-layer chromatography and confirmed by infrared spectroscopy. Acetylcholinesterase inhibition was determined manometrically for each metabolite. Malathion half-ester had one-third the enzyme toxicity of malathion while other metabolites showed essentially no enzyme inhibition. Conversion of malathion to malathion half-ester may represent complete malathion degradation, but not complete insecticide detoxication. Upon its return to the soil environment, the bacterium's ability to degrade malathion was severely impeded. The loss of activity was attributed either to the bacterium's inability to reestablish itself in the soil after prolonged culturing or to adsorption of the bacterial cells by the soil solids, rendering the cells unavailable for insecticide metabolism. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-25,991).

74-0121. Tomlin, A. D. (Rutgers-The State University, New Brunswick, NJ). **The toxicity, penetration and metabolism of Gardona in gypsy moth larvae.** *Diss. Abstr. Int. 33(4): 1410B; 1972.*

During studies on basic responses of gypsy moth (*Porthetria dispar*(L.)) larvae to insecticides, metabolism of Gardona (tetrachlorvinphos) was studied in 3rd-instar larvae after topical application of radiolabeled or unlabeled insecticide. Four metabolic products were found by combined TLC-GLC analysis after incubation of the treated larvae for 24 hours. The metabolites were identified as 2,4,5-trichloroacetophenone; 1-(2', 4', 5',-trichlorophenyl)ethan-1-ol; 2,4,5-trichloro-phenacyl chloride; and 1-(2', 4', 5'-trichlorophenyl)-2-chloroethan-1-ol. Total recovery of the applied material was about 47%; approximately 75% of the recovered material was unchanged Gardona. About 2% of the recovery total consisted of the first three compounds mentioned from the larval homogenates. After acid hydrolysis 11.8%, 0.8%, and 0.4% were extracted as the last three compounds, respectively, from the larval homogenate. The frass after acid hydrolysis contained 5.8% and 3.5% of II and III respectively. Since these compounds are of very low toxicity, and presumably the conjugated forms would be even less toxic, a detoxication mechanism has been demonstrated. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-27,603.)

74-0122. Adams, G. K. (Univ. of Maryland, College Park, MD). **Studies of spontaneous recovery of central respiratory function after acetylcholinesterase inhibition by organophosphates.** *Diss. Abstr. Int. 33(5): 2242B; 1972.*

Spontaneous recovery of central respiratory function after organophosphate poisoning was studied in

anesthetized guinea pigs pretreated with atropine methylnitrate to protect muscarinic sites outside of the central nervous system. The intravenous administration of soman (38 μg/kg) or sarin (880 μg/kg) produced an immediate disruption of phrenic nerve activity and resulting ventilatory failure. Animals were maintained on artificial respiration until spontaneous functional recovery was complete, as evidenced by the reestablishment of synchronized burst activity in the phrenic nerve and the return of tracheal airflow. Animals were sacrificed at predetermined intervals after intoxication, and the brainstem homogenates were analyzed for AChE. Results showed no significant return of AChE activity after one hour although functional recovery of respiration was complete within this time. Following the spontaneous restoration of ventilatory function, subsequent injections of the organophosphorus compounds failed to reinstate the central respiratory paralysis although they further depressed the brainstem AChE levels. The data suggests that the spontaneous recovery of central respiratory function after intoxication with soman or sarin may not be related to the return of AChE activity. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-29,422).

74-0123. Kravchenko, V. I.; Lukashova, R. G. (Kiev Res. Inst. of Endocrinol. and Metabolism, Kiev, USSR). **Vplyv khlodytanu (*o,p'*-DDD) na utvorennya kortiykosteroyidiv u nadnyrkovykh zalozakh kurchat. [The effect of chlodithane (*o,p'*-DDD) on corticosteroid formation in adrenal glands of chicks.]** *Dopov. Akad. Nauk Ukr. RSR, Ser. B. 35: 271-273; 1973.* (9 references) (Ukrainian)

Corticosteroid level was studied in the blood plasma of 10 days' old Leghorn chicks. Corticosteroid inhibition was noted with an intra-muscular introduction of 5-20 mg of *o,p'*-DDD (TDE). A dose of 2.5 mg administered for 30 days did not affect corticosteroid formation. A study of the synthesis of 11-hydroxycorticosteroids from pregnenolone and progesterone and of corticosterone from deoxycorticosterone in chick adrenal homogenates indicated that *o,p'*-DDD inhibited corticosteroid synthesis by inhibiting 11β-hydroxylase activity.

74-0124. Deckert, F. W. (Biochem. Pharmacol. Lab. 18, Rohm & Haas Co. Res. Lab., Spring House, PA 19477). **Warfarin metabolism in the guinea pig. I. Pharmacological studies.** *Drug Metab. Disposition 1(5): 704-710; 1973.* (20 references)

About 50% of the ^{14}C was recovered from the first 12-hr urine samples of guinea pigs given 1 or 2 mg injections of labeled warfarin; 86% was found there within seven days. Age of the animals did not affect the excretion of radioactive metabolites, but increased doses decreased the initial percentage of the drug and its metabolites excreted. The bulk of the radioactivity eliminated was in the form of DHG, 4-hydroxywarfarin, and warfarin, and small amounts of 7-hydroxywarfarin, 8-hydroxywarfarin, salicylic acid, and 6-hydroxywarfarin were present. Only 4'-hydroxywarfarin and DHG showed anticoagulant activity. The parent compound, administered at 1 mg/kg, increased clotting time to a maximum of 56 seconds at 36 hours; recovery was complete in 72 hours.

74-0125. Da Lage, C.; Alnot, M. O. (Lab. d'Histol. et Embryol., Fac. de Med. Necker, Paris Cedex 15, France). **Effets teratogenes de certains pesticides sur les embryons d'oiseaux et de mammiferes. [Teratogenic effect of certain pesticides on avian and mammal embryos.]** *Econ. Med. Anim. 14(3): 141-150; 1973.* (33 references) (French)

The teratogenic and embryotoxic effects of certain organochlorine and organophosphate pesticides were studied on avian and mammalian embryos. Incubation with parathion caused cervical lordosis, stiffening of the feet with paralysis, and dysmetria of the wings in chicken embryos and cervical lordosis with posterior cervical kyphosis in quail embryos. Incubation of pheasant eggs in 2,4-D caused high rates of fetal death, cervical lordosis, and muscular dystrophy of the feet with total or partial paralysis. Pesticides depleted the hepatic glycogen reserves; reduced intracellular catecholamine levels in the adrenals; and caused abnormal persistence of the Muellerian ducts, formation of smaller non-differentialted testicles, rarefaction of gonocytes with total or partial sterility, non-differentiated ovaries, and a smaller number of female gonocytes with anomalies of the meiotic prophase. Methylparathion caused nanism and retarded ossification of the caudal vertebrae in rat and mice fetuses. *o,p'*-DDD (TDE) caused permanent estrus with sterility and polycystic ovaries in rats.

74-0126. Dikshith, T. S. S. (Ind. Toxicol. Res. Cent., Lucknow, Chattar Manzil Palace, India). **In vivo effects of parathion on guinea pig chromosomes.** *Environ. Physiol. Biochem. 3(4); 161-168; 1973.* (30 references)

Following local intratesticular administration of 0.05 mg parathion in male guinea pigs, chromosomes at spermatogonial metaphase exhibited severe fragmentation and clumping and liquefaction. Exchange figures were less frequently formed. The frequency of fragmentation averaged 14.30% and that of clumping and liquefaction averaged 7.60%.

74-0127. Darrow, D. C.; Addison, R. F. (Fish. Res. Board Canada, Marine Ecol. Lab., Bedford Inst. Oceanogr., Dartmouth, Nova Scotia, Canada). **The metabolic clearance of ^{14}C-*p,p'*-DDT from plasma and its distribution in the Thorny Skate, *Raja radiata*.** *Environ. Physiol. Biochem. 3(4): 196-203; 1973.* (16 references)

Thorny skate, caught at St. Margaret's Bay, Nova Scotia, and with natural levels of 2 to 30 ppb total DDT in their blood and 800 to 8000 ppb in their livers, were injected intravenously with ^{14}C-*p,p'*-DDT to investigate metabolic clearance of the pesticide and its distribution. Three linear components of the decline curve in plasma were obtained with half-lives of 20, 120, and 1110 min. DDT appears to distribute into a rapidly exchanging pool or compartment and then into two other compartments of progressively slower exchange. The metabolic clearance rate was calculated as 5.54 or 4.36 l./day, depending on whether the initial or final concentration of DDT in the infusion solution was used. This changed with time because of loss of the compound to the tubing. Uptake of DDT by the tissues appeared to be dependent on lipid content, and from 59 to 87% of the dose was found in the liver when assays were performed 2-8 days after exposure. Only small amounts of the insecticide were excreted over a 23-day period. About 90% of the material remained in the tissues. No significant amounts of metabolites were detected.

74-0128. Offner, H.; Konat, G.; Clausen, J.* (Neurochem. Inst., DK-2200 Copenhagen, Denmark.) **The effect of DDT, lindane and Aroclor 1254 on brain cell culture.** *Environ. Physiol. Biochem. 3(4): 204-211; 1973.* (29 references)

DDT was the most toxic of three chlorinated hydrocarbons tested at 100 μM on rat brain cell cultures; changes in cell morphology began to occur on the second day after introduction of the pesticide. The number of astrocytes decreased notably and degenerative changes in neurons and fibroblast-like cells were observed. All cells were completely destroyed in four days. Lindane intoxication began to be evident between the 16th and 19th day after initial exposure. No astrocytes were seen in the culture at this stage, and degenerated neurons and fibroblasts with vacuoles on and around the cell body appeared. Some neuron degeneration was noted in cultures exposed to Aroclor 1254 for 25 to 27 days. Initial growth with this polychlorinated biphenyl was normal, but in older cultures the cell fibers were less branched, and granular bodies could be observed on their surface.

74-0129. Cocks, J. A. (ARC Unit Invertebrate Chem. Physiol., Univ. Sussex, Falmer, Brighton, BN1 9QJ, England). **The effect of aldrin on water balance in the freshwater pulmonate gastropod (*Biomphalaria glabrata*).** *Environ. Pollut. 5(2): 149-151; 1973.* (2 references)

Exposure to colloidal solutions of aldrin, carbaryl, DDT, and malathion for 24 hr generally increased heartbeat of *Biomphalaria glabrata* at low doses and decreased heartbeat at high doses. Aldrin, carbaryl, DDT, and malathion were lethal at 300, 400, 137, and 520 μM, respectively. A progressive accumulation of body water was observed with aldrin exposure. At high levels of the pesticide this accumulation was 70% more than that found in untreated snails. Hemolymph spaces were swollen with fluid in treated animals, but the mechanism responsible for this swelling was not established. Distension could prevent snails from being able to retreat into their shells, making them more susceptible to predation.

74-0130. Kimbrough, R. D.; Linder, R. E. (U. S. Environ. Protect. Agency, Chamblee Toxicol. Lab., Chamblee, GA 30341). **The ultrastructure of the paraquat lung lesion in the rat.** *Environ. Res. 6(3): 265-273; 1973.* (12 references)

Adult female Sherman strain rats were fed 500 ppm paraquat in their diet. Four poisoned as well as three control rats were sacrified 1, 3, 5, 7, and 11 wk after onset of exposure. Two well-developed paraquat lung lesions were encountered. The alveoli of these lesions contained a very prominent amorphous material which was highly osmiophilic when examined with the electron microscope. It consisted of concentrically arranged whorls which were surrounded by or next to ess electron-dense lattice-like material. Additional ultrastructural findings in those and other lungs consisted of edematous and vacuolated membranous pneumocytes (type I) as well as endothelial cells. The granular pneumocytes were increased in 3 of 20 lungs of exposed animals. (Author abstract by permission of Academic Press)

74-0131. Wassermann, D.; Wassermann, M.; Cucos, S.; Djavaherian, M. (Dept. of Occup. Health, The Hebrew Univ., Hadassah Med. Sch., Jerusalem, Israel). **Function of adrenal gland-zona fasciculata in rats receiving polychlorinated biphenyls.** *Environ. Res. 6: 334-338; 1973.* (9 references)

The corticosterone plasma level and the storage of organochlorine compounds (OCC) were assessed in mature male rats receiving 250 ppm polychlorinated biphenyls (PCBs)-1221 for 10 wk. The storage of PCBs in the adipose tissue of rats which received 250 ppm PCBs-1221 reached a level of 5.8 ppm as against 0.065 ppm in controls. Organochlorine insecticide storage was also increased in rats receiving PCBs-1221 (0.65 ppm DDT as against 0.29 ppm in controls and 0.15 ppm dieldrin as against 0.02 ppm in controls) although they did not receive extra amounts of these OCI except the amount currently present in food and water. These data confirm some previous findings, i.e., the presence in the animal body of a larger quantity of an organochlorine compound may influence the metabolic clearance rate of other organochlorine compounds. The mean level of corticosterone in these rats was 12.3 μg/100 ml as against 6.2 μg/100 ml in control rats. The difference between the two groups was statistically significant ($P < 0.01$). These findings comply with morphological features of hyperfunction of the adrenal zona fasciculata

in rats receiving PCBs-1221 which we described in a previous study. The results are interpreted as evidence of the need for a higher level of glucosteroids in defense against the stressor character of PCBs-1221 and perhaps also of the need for catatoxic activity of glucosteroids. (Author abstract by permission of Academic Press)

74-0132. Korpachov, V. V. (Kiev Res. Inst. Endocrinol. and Metabolism, Kiev, USSR). **Zalezhnist' vsmoktuvannya *o,p'*-DDD vid dozy ta likars'koyi formy preparatu. [Dependence of *o,p'*-DDD absorption on dose and drug form.]** *Farm. Zh. (Kiev) 27: 64-66; 1972.* (5 references) (Ukrainian)

o,p'-DDD (TDE), known to block endocrine (including adrenal) function, has been used to treat Cushing's disease, adrenal carcinoma, and other hormonal disorders. Doses of 50 mg of *o,p'*-DDD/kg of body weight, 150 mg/kg, and 300 mg/kg in corn oil solution were administered per os to guinea pigs for 10 days; 150 mg/kg in the form of an oil emulsion and *o,p'*-DDD powder in an aqueous suspension were also given. The 300 mg/kg dose had the highest rate of absorption (84.4% ± 2.3). Doses of 25 mg and 50 mg/kg were equally well absorbed (90%) in dogs. *o,p'*-DDD absorption from the oil solution (75.5% ± 2.2) and the emulsion (77.5% ± 1.4) was 12-13% higher than absorption from the suspension.

74-0133. Zaika, A. P. (Kiev Sci. Res. Inst. Pharmacol. Toxicol., Ukr. SSR Min. Public Health, Kiev, USSR). **K voprosu o detoksikatsii dimetildikhlorvinilfosfata (DDVF) v organizme zhivotnykh. [Detoxification of DDVP in animals.]** *Fiziol. Aktiv. Veshchestva 4: 24-26; 1972.* (20 references) (Russian)

The detoxification of DDVP (dichlorvos) by different organs and tissues of rabbits was studied in vitro. The detoxification of DDVP was determined in butyrylcholine substrate by potentiometric titration of acetic acid in temperature-controlled cuvettes at 25°C and pH 8.2. The rate of cholinesterase inhibition was determined from the quantity of sodium hydroxide consumed during the titration of acetic acid formed by the hydrolysis of the substrate by cholinesterase. Detoxification of DDVP occurred in all organs and tissues of the rabbit examined: liver, kidney, lung, spleen, intestines, skin, heart, brain, muscles, and even erythrocytes and blood plasma. The DDVP-detoxifying activity was highest in blood plasma and the tissues of the intestinal wall and lowest in brain and muscular tissues.

74-0134. Kurchatov, G. V.; Lysenko, N. M.; Mizyukova, I. G.; Petrun'kin, V. Ye. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic., Polymers, Plastic Materials, Kiev, USSR). **O zavisimosti mezhu stroyeniyem i lechebnoy aktivnost'yu seru- i azotsoderzhashchikh soyendineniy. [On relationships between the chemical structure and the therapeutic activity of sulfur and nitrogen-containing compounds.]** *Fiziol. Aktiv. Veshchestva 4: 62-65; 1972.* (14 references) (Russian)

The therapeutic efficiency of aliphatic and fatty-aromatic thiols, ethanolamines, alpha-aminothiols, and their derivatives, and sulfur-acyl and sulfur-alkyl derivatives as possible antidotes for organochlorine pesticides was studied in mice and rats poisoned with LD50 and higher doses of heptachlor. The animals were administered the tentative antidotes subcutaneously or orally 20-30 min prior to and immediately after introduction of the pesticide. The different thiols, including water-soluble and liposoluble ones, monothiols and dithiols, unithiol, mercaptide, and cysteine, had no positive therapeutic effect. Monoethanolamine, its sulfur-free mono-substituted derivatives, and triethanolamine had rather negative than positive therapeutic effect. Compounds with two ethanolamine groups and some sulfur-containing monoethanolamine derivatives prolonged the life of the animals. Oxy-derivatives of sulfur-acyl-alpha-aminothiols, either water-soluble or liposoluble, had significant positive therapeutic effect in terms of the reduction of the death toll.

74-0135. Terziev, G.; Popova, M. (I. P. Pavlov Higher Med. Inst., Plovdiv, Bulgaria). **On the acute mortal poisoning with rogor in experimental conditions and its chemical determination.** *Folia Med. (Plovdiv) 13(6): 345-352; 1971.* (15 references)

Administration of rogor (dimethoate) to rats at 1.5 LD50 induced central nervous system effects including transient excitation followed by relaxation, clonic contractions of the extremities and the trunk, ataxia, and pareses of the extremities. Death occurred between 33 min and 2.15 hrs. Post-mortem examination showed circulatory disturbances, degenerative changes in the nerve cells, some pulmonary edema, and protein dystrophy in the parenchymal organs. Pesticide levels, determined by a colorimetric method developed specifically for rogor, were found to be highest in stomach (256-881 μg/g) and small intestine (226-504 μg/g). The method included extraction with ether, TLC, and reaction with 2,6-dibromo-*p*-benzoquinone-4'-chlorimine in alkaline solution to form a blue color. The precision, sensitivity and specificity of the procedure were good. IR and spectrophotometric analysis of residues in the tissues indicated that breakdown was most complete in the kidney.

74-0136. Shtenberg, A. I.; Orlova, N. V.; Torchinskiy, A. M. (Inst. Nutrition, USSR Acad. Med. Sci., Moscow, USSR). **O deystvii pestitsidov razlichnoy khimicheskoy struktury na gonady i embriogenez eksperimental'nykh zhivotnykh. [The action of pesticides of differennt chemical structure on the gonads and embryogenesis of experimental animals.]** *Gig. Sanit. 38(8): 16-20; 1973.* (8 references) (Russian)

Relationships between the gonadotoxic, teratogenic, and embryotoxic effects, and between the chemical structures and the embryotoxic effects of carbaryl, benlate, and maneb were studied in chronic 11-12-month-poisoning tests on male and female Wistar rats. Daily 30 mg/kg doses of maneb initially increased and subsequently depressed the glucose-6-phosphate dehydrogenase activity in the ovaries and testicles and inhibited the succinate dehydrogenase activity. Daily 2 mg/kg doses of carbaryl and benlate did not change the glucose-6-phosphate dehydrogenase and succinate dehydrogenase activities. The changes in the glucose-6-phosphate dehydrogenase and succinate dehydrogenase activities paralleled the development of the pathological process in the ovaries and testicles, showing the possibility of using enzyme activities as indices of pathological process. Of the three pesticides, maneb had the strongest gonadotoxic effect; carbaryl had predominantly embryotoxic effects; benlate produced teratogenic effects. The maximum ineffective doses of benlate and carbaryl, established via gonadotoxic and embryotoxic criteria, are 0.003 LD50 and 0.01 LD50; and 0.0025 and 0.01 LD50, respectively. The fact that benlate has only teratogenic effects and carbaryl only embryotoxic effects on the same species is ascribed to the differences in the chemical structures of the two compounds.

74-0137. Leybovich, D. L. (Kiev A. N. Marzeyev Sci. Res. Inst. Pub. Communal Hyg., Kiev, USSR). **Otsenka embriotropnogo deystviya malykh doz fosfororganicheskikh yadokhimikatov - khlorofosa, metafosa i karbofosa. (Assessment of embryotropic action of small doses of phosphororganic pesticides chlorophos, metaphos and carbophos.)** *Gig. Sanit. 38(8): 21-24; 1973.* (5 references) (Russian)

The possible embryotropic action of ineffective doses of chlorophos (trichlorfon), metaphos (parathion), and carbophos (malathion) was studied in pregnant rats and their offspring. The animals were fed daily 0.1 mg/kg doses of trichlorfon, metaphos, and carbophos and 0.1 mg/kg doses of a mixture of trichlorfon with metaphos. Reduced rates of conception and reduced fertility (litters of 5.5 to 7.4 against a control value of 9.6) in the groups fed trichlorfon, metaphos, and their mixture were established. Resorption of the fetuses, edema and hyperemia of the uterus, and absence of corpora lutea were observed in the same groups. Most of the offspring in these groups died within the first postnatal month. Plethora, stasis, perivascular edema, and dystrophic changes in the brain nerve cells of the offspring were found during histological investigations. Metaphos had more pronounced embryotropic effects than trichlorfon, and additive effects of mixtures of trichlorfon with metaphos were determined. Carbophos did not cause changes in the reproductive functions and viability of the offspring.

74-0138. Shtabskiy, B. M. (Lvov Inst. Med., Lvov, USSR). **Kolichestvennaya otsenka yavleniy kumulyatsii. [Quantitative assessment of cumulation phenomena.]** *Gig. Sanit. 38(8): 24-28; 1973.* (9 references) (Russian)

A complex biological method is presented for the quantitative assessment of the cumulative properties of poisonous substances, including pesticides, upon single and repeated exposures. First, the oral LD50 value is determined via the number of deaths occurring within 24 hr after administration of a single dose along with numbers of deaths occurring during the entire observation period. In this manner, a cumulation index is obtained, and the mean time elapsing before death is determined. An analogous mean time to death is determined in another experiment comprising the repeated administration of one half LD50. In another subacute experiment the intervals between administrations of the dose are increased to two days, and an LD50 value for five subsequent introductions is obtained. In the case of a single introduction of the poison, the half-life of the substance in the body is approximately determined from the ratio of the LD50 to the ET50 (mean time elapsing until death). For *n*-fold introduction of one half LD50, ET50 is chosen as a criterion of the half-life. The half-life is estimated from the effect produced in the case of twofold introduction of LD16-LD30 doses. The half-life values obtained are used for assessing the cumulative property of the toxic substance. The cumulation factors determined in this manner for trichlorfon, prometryne, and barban are 4.9, 1.4, and 2.2-2.5.

74-0139. Khasanov, Yu. U.; Akhmedova, R. A. (Uzbek Sci. Res. Inst. Sanit., Hyg., Occup. Dis., Tashkent, USSR). **Materialy k obosnovaniyu predel'no dopustimoy kontsentratsii butifosa v vodoyemakh. [Data for establishing the maximum permissible concentration of butyphos in reservoirs.]** *Gig. Sanit. 38(8): 92-93; 1973.* (Russian)

Toxicological and organoleptic investigations were carried out to establish the maximum permissible concentration of butyphos (DEF) in reservoirs. The odor threshold and taste threshold concentrations were determined as 0.0152±0.00063 mg/l. and 0.00046±0.0003 mg/l., respectively. The threshold concentration with respect to hygienic criteria (biological oxygen demand and growth of saprophytic microflora) is 0.3 mg/l. The oral LD50 values of butyphos in guinea pigs, albino mice, albino rats, and rabbits, are 140, 179, 217, and 242 mg/kg. A high degree of uptake and a cumulation coefficient of 15.4 were determined. Rats chronically poisoned with 1/20 and 1/10 LD50 displayed increases in the urinary excretion of hippuric acid, disturbance in hepatic protein synthesis and carbohydrate metabolism, increased SGPT, and reduced SGOT activities. The maximum permissible concentration of butyphos in water is set at 0.003 mg/l. on the basis of its organoleptic properties.

74-0140. Didenko, G. G.; Chernov, O. V.; Gupalovich, T. D. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic., Polymers, Plastic Materials, Kiev, USSR). **Issledovaniye vozmozhnogo blastomogennogo deystviya gamma-izomera geksakhlortsiklogeksana (lindana). [Study of possible blastomogenic effects of gamma-BHC (lindane).]** *Gig. Sanit. 38(8): 98-99; 1973.* (3 references) (Russian)

Albino mice were fed 25 mg/kg doses of lindane in sunflower seed oil twice a week for five consecutive weeks to study possible blastomogenic effects. Histological studies, performed 1.5, 3, 4.5, 6, 9, and 12 months after poisoning, did not reveal evidence of tumor formation or precancerous conditions in the test animals. The frequency of pulmonary adenomas was similar to that in a control group. No changes were noted in the blood serum desoxyribonuclease, hexokinase, and cholinesterase activities (indicators of tumor formation) during the observation period.

74-0141. Burkatskaya, N. Ye.; Matyushina, V. I.; Ivanova, Z. V. (Inst. Ind. Hyg. Occup. Dis., Kiev, USSR). **Gigiyenicheskaya otsenka novogo insektitsida i akaritsida – dikrezilovogo efira *N*-metilkarbaminovoy kisloty. [Hygienic appraisal of the new insecticide and acaricide, dicresyl ester of *N*-methylcarbamic acid.]** *Gig. Sanit. 38(8): 99-101; 1973.* (4 references) (Russian)

A toxicological study of the dicresyl ester of *N*-methylcarbamic acid (dicresyl) was performed on mice and rats, and hygienic implications of the use of this pesticide for veterinary purposes were investigated. The LD50 values for rats and mice are 471 and 271 mg/kg. The percutaneous LD50 for rats is 896 mg/kg. A cumulation coefficient higher than 5 was determined in chronic experiments in rats. Maximum cholinesterase inhibition (72% in blood serum, 49% in erythrocytes, 78% in hepatic tissues, and 71% in the kidney) was found in rats 40 min after administration of the maximum non-lethal dose. No carcinogenic effect of dicresyl was evidenced in two generations of mice. Dicresyl concentrations of 3.4-43.4 mg/m^3 and skin deposits of 0.002-0.5 mg/cm^2 were measured during the preparation and application of dicresyl emulsions to cattle. Exposure to such dicresyl concentrations for 1-2 days caused 24-43% reductions in the cholinesterase activity of the workers. The maximum permissible concentration of dicresyl in the workplace is set at 0.5 mg/m^3.

73-0142. Stuneyeva, G. I. (Ryazan I. P. Pavlov Inst. Med., Ryazan, USSR). **Sanitarno-gigiyenicheskiye usloviya primeneniya i toksikologicheskiye svoystva smesi, sostoyashchey iz kel'tana, khlorofosa i khlorokisi medi. [Sanitary-hygienic conditions of use and the toxicologic characteristics of mixtures containing kelthane, trichlorfon, and cupric chloride.]** *Gig. Sanit. 38(8): 101-103; 1973.* (4 references) (Russian)

Air concentrations of technical mixtures of trichlorfon, kelthane (dicofol), and cupric chloride were measured during preparation and application of the mixtures in orchards; the toxicity of the preparations was also studied in acute and subacute tests on male rats. The kelthane, trichlorfon, and cupric chloride concentrations in the air during the preparation of technical solutions manually and mechanically were 2.26, 2.95, and 1.970 mg/m^3. The corresponding concentrations measured during application by sprayers were 1.644, 2.142, and 1.68 mg/m^3. Following exposure to such concentrations for 8-10 hr a day on 4-5 successive days at 14-20 day intervals, 22-30% reductions in cholinesterase activity, a tendency to erythropenia, a slight reduction in the hemoglobin level, neutropenia, eosinophilia, and leukopenia were diagnosed in workers. The LD50 of a 2:3:3 mixture of trichlorfon, kelthane, and cupric chloride in rats was 1,270±101.1 mg/kg, while the corresponding individual LD50 values for trichlorfon, kelthane, and cupric chloride are 295, 433, and 542 mg/kg, indicating an antagonistic effect of the individual components.

74-0143. Shpirt, M. B. (Kirgiz Inst. Epidemiol., Microbiol., Hyg., Frunze, USSR). **Toksikologicheskaya otsenka DDT, GKhTsG, TMTD, sevina, tsineba pri deystvii na kul'tury kletok cheloveka. [Toxicological assessment of DDT, BHC, TMTD, sevin, and zineb acting on human cell cultures.]** *Gig. Tr. Prof. Zabol. 17(3): 32-35; 1973.* (15 references) (Russian)

The cytotoxic effects of 0.001, 0.01, 100, and 1,000 mg/kg concentrations of DDT, BHC, TMTD (thiram), sevin (carbaryl), and zineb were studied in human embryonic fibroblast, human amniotic cell, and Detroit cell cultures. Cell cultures were investigated after 4, 24, 48, 72, 96, 120, 144, 168, and 192 hr of incubation. All the preparations under study were antimitotic, damaging cells in the telophase, interphase, and preprophase. Direct dose-effect relationships were revealed by the decrease observed in the coefficients of mitosis with increased pesticide concentrations from 0.001 to 1,000 mg/kg (from 3.77 to 0.60% for DDT, 3.71 to 1.66% for BHC, 2.93 to zero for TMTD, 2.84 to zero for carbaryl, and 4.08 to zero per cent for zineb) and by the corresponding increases in the degeneration indices from very low values to 100%. The mean lethal doses (in mg/kg) and the cumulation factors were 232.0±5.8 and 0.08 (DDT), 240.4±6.4 and 0.88 (BHC), 210.0±16.8 and 0.43 (TMTD), 167.2±7.9 and 0.55 (carbaryl), and 1,976.3±39.9 and 0.51 (zineb).

74-0144. Buslovich, S. Yu.; Voinova, I. V.; Mil'china, M. G. (Inst. Sanit. Hyg., Minsk, USSR). **Raspredeleniye gerbitsidov - khlorproizvodnykh fenoksikislot v organizme belykh krys. [Distribution of herbicidal chloro- phenoxy-acids in the body of albino rats.]** *Gig. Tr. Prof. Zabol. 17(3): 35-37; 1973.* (8 references) (Russian)

The distribution of 2,4-D, the sodium salt of 2,4-D, the diethylamine salt of 2,4-D, and of rankotex (2-methyl-4-chlorophenoxypropionic acid, MCPP) was studied in albino rats. The rats were given single parenteral 555 mg/kg doses of 2,4-D sodium salt and 405 mg/kg doses of 2,4-D diethylamine salt (both LD50). Daily 91 and 23 mg/kg doses of 2,4-D, 111 and 28 mg/kg doses of 2,4-D sodium salt, 80 and 20 mg/kg doses of 2,4-D diethylamine salt, and 195 and 49 mg/kg doses of rankotex (1/5 and 1/20 of LD50) were administered for 50 days in another experiment. The highest 2,4-D sodium salt and diethylamine salt concentrations in the blood were found three hours after the administration of the respective single doses. The half-retention periods determined for 2,4-D sodium salt and diethylamine salt were 53.1 hr and 72 hr. The 2,4-D diethylamine salt concentrations in the organs were highest 24 hr after poisoning (292 μg/g in the heart, 452 μg/g in the liver, 365 μg/g in the kidney, 141 μg/g in the skeletal muscles, and 135 μg/g in the brain). After three days the residue levels were highest in the kidney. The 2,4-D, 2,4-D sodium salt, 2,4-D diethylamine salt, and rankotex concentrations in the heart, liver, kidney, skeletal muscles, and brain of rats poisoned for 50 days were relatively low with the respective ranges of 8.5-156 μg/g in the heart, 10.1-124 μg/g in the liver, 4.5-204 μg/g in the kidney, 1.47-69.6 μg/g in the skeletal muscles, and zero to 61.6 μg/g in the brain, depending on the dose administered and the water solubility of the preparation.

74-0145. Abramova, Zh. I.; Fridman, S. M. (Inst. Ind. Hyg. Occup. Dis., Ufa, USSR). **K razrabotke patogeneticheskikh metodov diagnostiki proizvodstvennykh intoksikatsiy tetrametiltiuramdisul'fidom. [Pathogenetic methods for the diagnosis of industrial TMTD poisonings.]** *Gig. Tr. Prof. Zabol. 17(3): 45-48; 1973.* (17 references) (Russian)

Subacute poisoning tests with TMTD (thiram) were carried out on Wistar rats to study possible diagnostic methods. The test animals were given parenterally 25 mg of TMTD per kg of body weight per day for 2-12 weeks. Utilization of pyridoxine and nicotinic acid was reduced, and hypovitaminosis symptoms developed. Subacute poisoning with TMTD also disturbed the copper turnover, manifested by phasic changes in the ceruloplasmin activity and the copper levels of different organs. Methods suitable for the detection of disturbances in the copper turnover (plasma ceruloplasmin activity test), in the vitamin B6 turnover (urinary excretion of 4-pyridoxic and xanthurenic acids), as well as the blood NAD + NADP levels and the urinary excretion of NIMNA, and serotonin excretion were relevant in the pathogenetic diagnosis of TMTD poisonings.

74-0146. Barnola, F. V.; Camejo, G.; Villegas, R. (Cen. Biofisica Bioquimica, Inst. Venezolano Investigaciones Cientificas (IVIC), Apartado 1827, Caracas, Venezuela). **Ionic channels and nerve membrane lipoproteins: DDT-nerve membrane interaction.** *Int. J. Neurosci. 1: 309-316; 1971.* (22 references)

Incubation of first stellar nerve tissue of the squid with ^{14}C-DDT resulted in accumulation of 1.3 nmole DDT/mg protein in plasma membrane fraction I (tentatively identified as the axolemma) and 1.0 nmole DDT/mg protein in plasma membrane fraction II (tentatively identified as the plasma membranes of the satellite cells). DDT reduced the fluorescence of protein aromatic residues but only when protein was bound to lipids. Under low pressure conditions lipid molecules at the interface apparently did not prevent DDT from reaching the surface after injection. Similar experiments demonstrated a greater affinity of DDT for cholesterol than for lecithin, and human high-density lipoprotein had a much greater affinity for the pesticide than lipid-free apo-high-density lipoprotein. The results suggest that the pharmacological effect of DDT may be due to its interaction with the nerve membrane lipoprotein. DDE, which is pharmacologically less active, did not affect the fluorescence of the nerve membrane lipoprotein.

74-0147. Whiting, F. M.; Brown, W. H.; Stull, J. W. (Dept. of Dairy and Food Sci., Univ. of Arizona, Tucson, AZ 85721). **Pesticide residues in milk and in tissues following long, low 2,2-bis(*p*-chlorophenyl)-1,1,1-trichloroethane intake.** *J. Dairy Sci. 56(10): 1324-1328; 1973.* (20 references)

Unbred heifers in three groups of four animals were fed one of three 2,2-bis(*p*-chlorophenyl)-1,1,1-trichlorethane (DDT) intakes: 250, 500, or 1,000 ppb (parts per billion) of the total feed consumed. The animals were maintained on these intakes until ends of their first lactations when one animal in each group was sacrificed for tissue sampling and analysis. The nine remaining animals were then placed on a relatively pesticide-free diet during their second lactation. In lactation 1, as dosage decreased, the ratio of feed dose to milk fat pesticide residue increased. A 1,000 ppb feed gave a ratio of 1:2.2, 500 ppb resulted in 1:2.5, and 250 ppb yielded 1:3.5. In the second lactation, the biological half-life for the group receiving 250 ppb of pesticide (7.3 pm) was greater than that for the groups receiving 500 ppb (3.9 mo) or 1,000 ppb (4.4 mo). Renal and udder adipose tissues and total udder tissue had the most pesticide at each dosage with 2,2-bis(*p*-chlorophenyl)-1,1-dichloroethane (DDE) being the major metabolite. Despite the relatively low blood 2,2-bis(*p*-chlorphenyl)-1,1-dichloroethane, this metabolite could indicate previous 2,2-bis(*p*-chlorophenyl)-1,1,1-trichloroethane exposure. (Author abstract by permission)

74-0148. Aziz, S. A.; Knowles, C. O. (Dept. of Entomol., Univ. of Missouri, Columbia, MO 65201). **Oxythioquinox acaricide: toxicological studies with twospotted**

spider mites. *J. Econ. Entomol. 66(5): 1041-1045; 1973.* (11 references)

Oxythioquinox acaricide was highly toxic to *Tetranychus urticae* Koch, with a 24-hour LC50 of 3.1 ppm. Spider mites rapidly hydrolyzed the compound to 6-methyl-2:3-quinoxalinedithiol (QDSH), itself a toxicant, and to other unidentified polar metabolites both in vivo and in vitro. Using equilibrium dialysis, it was shown that oxythioquinox was irreversibly bound to bovine serum albumin and to proteins in the spider mite homogenate, rat brain, liver, and blood. Binding was blocked by sulfhydryl reagents and Triton X-100. It was suggested that binding of oxythioquinox to proteins probably involved a mechanism by which the sulfhydryl group of proteins initially attacked the carbonyl carbon of the acaricide. The acaricidal action of oxythioquinox may be due, in part, to disruption of the normal function of significant proteins by the parent compound itself and perhaps by QDSH. (Author abstract by permission)

74-0149. Miller, R. W.; Pickens, L. G. (Agr. Environ. Qual. Inst., Agr. Res. Serv., U. S. Dept. of Agr., Beltsville, MD 20705). **Feeding of coumaphos, ronnel, and rabon to dairy cows: larvicidal activity against house flies and effect on insect fauna and biodegradation of fecal pats.** *J. Econ. Entomol. 66(5): 1077-1079; 1973.* (8 references)

Eight dairy cows, 2/treatment, were fed a concentrate–alfalfa hay pellet–corn silage ration supplemented as follows (1) no insecticide, (2) 56 ppm coumaphos, (3) 56 ppm Rabon (2-chloro-1-[2,4,5-trichlorphenyl] vinyl dimethyl phosphate, tetrachlorvinphos), or (4) 112 ppm ronnel. Larvicidal activity against *Musca domestica* L. was significantly greater in feces from cows fed Rabon than in feces from cows fed either coumaphos or ronnel. Milk from cows fed coumaphos or Rabon contained no residues (<0.005 ppm); however, residues were detected in milk from cows fed ronnel. Feces examined after 6 or 9 weeks in a pasture showed no difference between the biodegradation of untreated and treated feces except that little tunneling was observed in the pats containing coumaphos. This tunneling was apparently done by larvae of soldier fly, *Sargus cuparius* (L). (Author abstract by permission)

74-0150. Rusness, D. G.; Frear, D. S. (Plant Sci. Res. Div., Agr. Res. Serv. U.S.D.A., Metab. Radiation Res. Lab., Fargo, ND 58102). **The effect of injury on microsomal ascorbate levels, β-glucan synthesis and urea herbicide *N*-demethylation in etiolated cotton hypocotyl tissue.** *J. Exp. Bot. 24(79): 272-284; 1973.* (29 references)

N-demethylation of urea herbicides by microsomes from injured (excised) plant tissue was inhibited in a non-competitive, curvilinear manner when NADPH concentration was rate-limiting. Gel filtration and dialysis removed the inhibiting agent, and fractions of this agent (ascorbate or dehydroascorbate) or ascorbate added to separated microsomes inhibited *N*-demethylase activity. Exposure of tissue in the light to CN^- and S_2O^{2-} abolished the inhibition of fluometuron demethylation. β-Glucan (cellulose) synthetase was stimulated during plant injury and by ascorbate or the fraction inhibiting *N*-demethylation.

74-0151. Iyengar, L.; Rao, A. V. S. P. (Dept. Civ. Eng., Indian Inst. Technol., Kanpur-16, India). **Metabolism of chlordane and heptachlor by *Aspergillus niger*.** **J. Gen. Appl. Microbiol. 19(4): 321-324; 1973. (7 references)**

At initial concentrations below 12.5μg/ml, chlordane and heptachlor were reduced to levels lower than the limit of detection by *Aspergillus niger* in 48 hr. Chlordane disappeared more rapidly than heptachlor in the presence of *A. niger* when larger initial concentrations were used while heptachlor was utilized more rapidly. At concentrations up to 50 μmg/ml, slight increases in mycelial weight were observed with both pesticides, but neither could serve as sole source of carbon. Chlordane-adapted *A. niger* utilized chlordane, heptachlor, and aldrin, but not BHC and DDT.

74-0152. Boyle, W. S. (Utah State Univ., Logan, UT 84321). **Cytogenetic effects of Benlate fungicide on *Allium cepa* and *Secale cereale*.** *J. Hered. 64(1): 49-50; 1973.* (3 references)

A low frequency of aberrations, primarily lagging chromosome fragments, was observed in mitotic root tips of the onion, *Allium cepa*, after 24 or 48 hr of exposure to 1200 ppm Benlate solution. Treatment of culms of rye (*Secale cereale*) containing young spikes with Benlate at 1200 ppm for four days resulted in a low frequency of univalents in meiotic pollen mother cells. Chromosome shortening and stickiness were also observed.

74-0153. Ulland, B. M.; Weisburger, J. H.; Weisburger, E. K.; Rice, J. M.; Cypher, R. (Bionetics Res. Lab., Kensington, MD 20795). **Thyroid cancer in rats from ethylene thiourea intake.** *J. Nat. Cancer Inst. 49(2): 583-584; 1972.* (12 references)

Follicular or papillary cancers of the thyroid occurred in 17 of 26 male rats and 8 of 26 female rats given 350 ppm ethylene thiourea in the diet for 18 months. At this dose 17 males and 13 females also had hyperplastic goiter. These conditions were also found, but less frequently, at a dose level of 175 ppm. Three solid-cell thyroid adenomas and four hyperplastic nodules of the liver were observed in the treated animals, but not in the controls.

74-0154. Bishara, R. H.; Born, G. S.; Anderson, V. L.; Christian, J. E. (Anal. Dev. Dept., Eli Lilly Co., Indiana-

polis, IN 46206). **Statistical approach to evaluating effect of physical and chemical factors on fecal excretion of chlorophenothane.** *J. Pharm. Sci. 62(9): 1420-1424; 1973.* (45 references)

Cold treatment was the most effective of those treatments studied in stimulating fecal excretion of ^{14}C-DDT (administered five days previously) and/or its metabolites in rats, probably as a result of fat mobilization and the greater availability of the pesticide for metabolism. The effect diminished as the animals adapted to the cold treatment. Administration of levarterenol or diphenylhydantoin for three days beginning the 5th day after injection of the pesticides did not affect elimination, but pretreatment with diphenylhydantoin increased the initial fecal elimination of ^{14}C. The statistical designs used in the experiment (randomized complete block and completely randomized) supplied reliable data using a minimum of animals and quantity of radioisotope.

74-0155. Smith, A. E. (Univ. Georgia, College Agr., Exp. Sta., Experiment, GA 30212). **Influence of 2,4-D and 2,4,5-T on in vitro digestion of forage samples.** *J. Range Manage. 26(4): 272-274; 1973.* (16 references)

Results from three experiments indicate that 2,4-D and 2,4,5-T at concentrations expected to occur in the rumen of steers grazing on treated pasture would not alter digestive activity in the rumen or growth of rumen microorganisms. At 10^{-8} to 10^{-4} *M* the herbicides did not affect the in vitro digestion of ground corn silage and bermudagrass foliage. The dry weights of rumen microorganisms recovered from control sucrose and herbicide-sucrose incubation mixtures did not differ significantly after 11 days' exposure. Microorganisms in rumen liquor did not degrade 2,4-D or 2,4,5-T during a 10-day incubation period with or without bermudagrass foliage as an energy source.

74-0156. Longcore, J. R.; Samson, F. B. (Patuxent Wildl. Res. Cent., Laurel, MD 20810). **Eggshell breakage by incubating black ducks fed DDE.** *J. Wildl. Manage. 37(3): 390-394; 1973.* (24 references)

Black duck (*Anas rubripes*) hens fed 10 ppm dry weight (approximately 3 ppm wet weight) of *p,p'*-DDE in the diet laid eggs with shells 22 percent thinner at the equator, 30 percent thinner at the cap, and 33 percent thinner at the apex than those of controls. Natural incubation increased shell cracking more than fourfold as compared with mechanical incubation. Hens removed cracked eggs from nests, and one hen terminated incubation. Hens fed DDE produced one-fifth as many ducklings as controls. DDE in eggs of dosed hens averaged 64.9 ppm wet weight. (Author abstract by permission)

74-0157. Hollingworth, R. M.; Alstott, R. L.; Litzenberg, R. D. (Dept. of Entomol., Purdue Univ., West Lafayette, IN 47907). **Glutathione *S*-aryl transferase in the metabolism of parathion and its analogs.** *Life Sci. 13(3): 191-199; 1973.* (16 references)

A soluble enzyme (glutathione *S*-aryl transferase) which converts parathion and related insecticidal organophosphorus triesters to *S-p*-nitrophenylglutathione and the corresponding dialkyl phosphorothioic or phosphoric acid has been identified and assayed in vertebrate liver. The activity of this enzyme can be differentiated from that of the analogous glutathione *S*-alkyl transferase also present in rat tissues. Its relationship to other known glutathione *S*-aryl transferases remains to be established but considerable differences in optimum pH have been observed. (Author abstract by permission)

74-0158. Walker, C. H.; El Zorgani, G. A. (Dept. of Physiol. and Biochem., Reading Univ., Berkshire, England). **Metabolism of a dieldrin analogue—secondary oxidation by liver microsomes.** *Life Sci. 13(5): 585-593; 1973.* (8 references)

HCE (1,2,3,4,9,9 hexachloro-exo-5,6 epoxy, 1,4,4a,5,6,7,8,8a-octahydro-1,4 methano naphthalene) was metabolized to a monohydroxy expoxide (HHC) by liver microsomes and 11,000 *g* supernatants of the rat, rabbit, pigeon, and Japanese quail. After a substantial amount of the substrate had been metabolized, HHC began to be hydroxylated to a more polar metabolite that was identified as dihydroxy HCE. Both metabolic conversions were evidently mixed function oxidations since they depended upon NADPH and O_2. Dihydroxy HCE was also produced in vivo by the rabbit and the quail. (Author abstract by permission)

74-0159. Levine, W. G. (Dept. of Pharmacol., Albert Einstein Coll. of Med., Yeshiva Univ., Bronx, NY 10461). **Effect of phenobarbital and 3-amino-1,2,4-triazole on the metabolism and biliary excretion of 3,4-benzpyrene in the rat.** *Life Sci. 13(6): 723-732; 1973.* (19 references)

The effects of 3-amino-1,2,4-triazole (amitrole) and phenobarbital, alone and in combination, on the metabolism and biliary excretion of 3,4-benzpyrene have been investigated in Wistar and Sprague-Dawley rats of both sexes. Although phenobarbital induced and aminotriazole inhibited metabolism, considerable variation with species and sex was observed. The effects of these drugs on liver weight, microsomal protein, and bile flow also varied among these groups of rats. It is apparent that there was no quantitative relationship between the pattern of excretion of benzpyrene metabolites and bile flow, microsomal protein, and liver weight. (Author abstract by permission)

74-0160. Bridges, B. A.; Mottershead, R. P.; Green, M. H. L.; Gray, W. J. H. (MRC Cell Mutat. Unit, Univ. Sussex, Falmer, Brighton BN1 9QH, England). **Mutageni-**

city of dichlorvos and methyl methanesulphonate for *Escherichia coli* WP2 and some derivatives deficient in DNA repair. *Mutat. Res. 19(3): 295-303; 1973.* (26 references)

Dichlorvos had mutagenic activity similar to, but much less potent than, that of methyl methanesulfonate (MMS) in *E. coli* WP2 and some derivatives deficient in DNA repair genes. A slight lag was observed before establishment of a constant rate of induction was seen when WP2 and WP2 *uvrA* strains were exposed to dichlorvos, and MMS at 0.04% induced about four times as many mutants in 60 minutes as dichlorvos at 0.2%. Strains carrying the *recA* or *exrA* alleles were mutated not at all or < 10% of the frequency for the isogenic *exrA*$^+$ strains, WP2 and WP2 *uvrA*. These results were observed without any detectable lethality in the populations and indicate that both MMS and dichlorvos induce base-repair-substitution mutations almost entirely via the error-prone *exrA*$^+$/*ecA*$^+$-dependent pathway for DNA repair. With both compounds, wild type and *urvA* strains were equally resistant to lethal action, *exrA* and *exrAuvrA* strains were more sensitive, and *polAuvrA, polAuvrAexrA* and *recA* strains were most susceptible.

74-0161. Benes, V.; Sram, R. J.; Tuscany, R. (Inst. Hyg. Epidemiol., Prague, Czechoslovakia). **Testing of mutagenicity of fenitrothione.** *Mutat. Res. 21(1): 23-24; 1973.*

Fenitrothion, tested along with TEPA, a positive control, in a 3-generation study in rats, did not increase the frequency of dominant lethal mutations or chromosomal aberrations. The pesticide was administered in doses of 10, 40, and 80 ppm; the frequency of dominant lethals was measured in males and females in each generation and those of chromosomal aberrations in the bone marrow of second generation. Since negative results ave been obtained with this compound repeatedly in *D. melanogaster*, it is considered not to induce a higher frequency of mutations in the systems tested. (Presented at the second annual meeting of the European Environmental Mutagen Society, Zinkovy Castle, Czechoslovakia, Abstract no. 6.)

74-0162. Buselmaier, W.; Roehrborn, G.; Propping, P. (Inst. Anthropol. Human Genetics, Univ. Heidelberg, Heidelberg, Germany). **Comparative investigations on the mutagenicity of pesticides in mammalian test systems.** *Mutat. Res. 21(1): 25-26; 1973.*

During the host-mediated assay in mice, significant increase in mutation rates was not observed after subcutaneous injection of DDT, DDE, DDA, hexachlorocyclohexane, dichlorvos, *p*-nitrophenol, 2,4,5-T, 2,4,5-T-*n*-butylester, MCPA, $NiCl_2$, pentachlorophenol, and pentachloronitrobenzene. Except for dichlorvos these pesticides also gave negative results in spot tests. After injection of DDD (TDE), highly significant increased rates of mutation were found with two of the three indicator organisms. In spot tests the number of back mutants did not increase, suggesting that TDE is activated to a mutagenic agent by the host organism. Captan induced mutations in vivo and in vitro with *Salmonella typhimurium* G46 and *Serratia marcescens* a21. DDT, DDA, 2,4,5-T, MCPB, and dichlorvos were tested in the dominant lethal assay and were not mutagenic. (Eur. Environ Mutagen Soc., Abstract no. 9)

74-0163. Cerey, K.; Izakovic, V.; Ruttkay-Nedecka, J. (Dept. Genetics, Postgrad. Med. Pharmaceutical Inst., Bratislava, Czechoslovakia). **Effect of heptachlor on dominant lethality and bone marrow in rats.** *Mutat. Res. 21(1): 26; 1973.*

Heptachlor, incorporated in the diet of rats at 1 and 5 ppm, caused dominant lethal changes in males from the three exposed generations. A statistically significant increase in the number of resorbed fetuses was seen in intact pregnant rats, and abnormal mitoses, abnormalities of chromatids, pulverization, and translocations in the bone marrow cells significantly increased. The results show that rat fetuses could be adversely affected by the use of heptachlor in early and late stages of their development. (Eur. Environ. Mutagen Soc.,Abstract no. 10)

74-0164. Styles, J. A. (Imperial Chem. Industries, Industrial Hyg. Res. Lab., Alderley Park, near Macclesfield, Cheshire, England). **Cytotoxic effects of various pesticides in vivo and in vitro.** *Mutat. Res. 21(1): 50-51; 1973.*

DDT, BHC, 2,4-D, 2,4,5-T, thiabendazole, parbendazole, mebendazole, benomyl, methyl benzothiodiazene carbamate, benzimidazole carbamate, and *N,N'*-di(1,3,4-thiadiazole-2-yl) methylenediamine were administered orally to rats and the effects examined in bone marrow cells and in cells cultured in the serum. Cytological effects in vitro were related to the levels of the compound in the medium and compared with the effects on bone marrow. *Salmonella typhimurium* was used as indicator organism in the host-mediated assay. The insecticides, herbicides, and several spindle poisons did not significantly increase the rates of mutation. Benomyl, benzimidazole carbamate, and *N,N'*-di(1,3,4-thiadiazole-2-yl) methylenediamine, along with some cytotoxic drugs, did increase the mutation rate. (Eur. Environ. Mutagen Soc.,Abstract no. 45)

74-0165. Mollet, P. (Zool. Inst., Eidg. Techn. Hochschule, Zurich, Switzerland). **Untersuchungen ueber Mutagenitaet und Toxizitaet von Captan bei Drosophila. [Studies on mutagenicity and toxicity of captan in Drosophila.]** *Mutat. Res. 21(3): 137-148; 1973.* (41 references) (German)

Mutagenicity and toxicity of captan in male Drosophila were examined by topical and intraperitoneal

administration. Captan was dissolved in saline or DMSO solution, and the known mutagenic alkylating agent, Trenimon, was used as a positive control. Toxicity was estimated from the ratios of induced mortality and sterility of the treated males. The mutagenicity determination was based on the frequencies of sex-linked recessive lethals in pre- and post-meiotic germ cell stages scored by the BASC method. Captan gave no evidence of mutagenicity at low, non-toxic or at high, toxic concentrations. Mutagenicity was not apparent even when captan was applied in dimethyl sulfoxide solution; trenimon was clearly mutagenic in the test system used.

74-0166. Kramers, P. G. N.; Knaap, A. G. A. C. (Dept. Radiation Genetics Chem. Mutagenesis, State Univ. Leiden, Wassenaarseweg 62, Leiden, The Netherlands). **Mutagenicity tests with captan and folpet in *Drosophila melanogaster*.** *Mutat. Res. 21(3): 149-154; 1973.* (17 references)

Three types of genetic damage were measured following injection or continuous feeding of *Drosophila* with captan, Orthocid (commercial captan formulation), or Phaltan (commercial folpet preparation). A study of sex-linked recessive lethal mutations in male germ cells did not reveal significant increases in mutation frequency. Feeding captan at concentrations of 0.3% and 1% did not produce translocations, and neither this nor treatment with Orthocid-83 produced evidence of dominant lethal mutations. In other test systems captan has given strongly positive results. Destruction of the compound before it reaches the gonads in an effective concentration may be responsible for the negative results observed in *Drosophila*.

74-0167. Dyer, K. F.; Hanna, P. J. (Genetics Dept., Monash Univ., Clayton, Victoria, 3168 Australia). **Comparative mutagenic activity and toxicity of triethylphosphate and dichlorvos in bacteria and Drosophila.** *Mutat. Res. 21(3): 175-177; 1973.* (10 references)

The mutagenic activity of triethylphosphate (TEP) in *S. typhimurium* and *P. aeruginosa*, described in a short communication, was similar to that of (TMP) trimethylphosphate and much lower than that of dichlorvos. TMP and TEP were also mutagenic in *Drosophila* at concentrations from 0.01 to 0.03 *M*. An unexpectedly high proportion of mutant gametes was obtained from males treated at the 0.02*M* level of TEP. During the course of the experiments, *Drosophila* were selected for marked increases in resistance to TMP, TEP, and DDVP.

74-0168. Dinnendahl, V.; Peters, H. D.; Helm, K. U.; Schoenhoefer, P. S. (Pharmakol. Inst. Rheinischen Friedrich-Wilhelms Univ., D-53 Bonn, Reuterstrasse 2 b, Germany). **Effect of paraoxon on the lipolytic system of fat cells.** *Naunyn Schmiedebergs Arch. Pharmakol. 274: R28; 1972.*

During in vitro experiments with epididymal fat cells, paraoxon caused a dose-related inhibition of lipolysis in the concentration range of the LD50 (10^{-7} to 10^{-5}). The inhibition was also observed in cells stimulated by norepinephrine or dibutyryl-A-3′,5′-MP and was not abolished by obidoxime, HS 6, or atropine. Enzymes involved in the adenyl cyclase system other than triglyceride lipase were not affected by paraoxon.

74-0169. Iwami, T.; Takahashi, M.; Osari, R.; Masaki, N.; Kajino, Y.; Sone, K.; Wakai, S.; Kimura, M. (Sch. Pharmacol., Fac. Med., Hirosaki Univ., Aomori, Japan). **[Experimental studies on subacute toxicity in mice and rats given kasugamycin orally for three months.]** *Nippon Kagaku Ryohogakukai Zasshi (Chemotherapy (Tokyo)) 21(6): 1184-1202; 1973.* (10 references) (Japanese)

To evaluate the safety of kasugamycin, a fungicide especially active against rice blast, a series of subacute toxicity tests was carried out. Kasugamycin hydrochloride was added at 10, 100, 1000, and 10,000 ppm to the daily diet of 20 mice and 15 rats of both sexes. Growth of mice and rats remained normal after three months of continuous administration of kasugamycin at 100 mg/kg body weight. Little or no direct disturbance of blood values was observed. Urinalysis revealed no obvious abnormality, such as the presence of occult blood, sugar, protein, or ketone bodies. Continuous administration of kasugamycin at more than 100 mg/kg for three months may produce some liver damage (slight changes in SGOT and SGPT). Determinations of inorganic phosphorus in blood, along with the pathohistological findings, indicate that administration of more than 1000 mg/kg caused distinct kidney disturbances. Macroscopic autopsy results and pathohistological findings suggest that the administration of kasugamycin at more than 100 mg/kg causes some digestive disturbances, such as gastritis.

74-0170. Hosokawa, S.; Miyamoto, J. (Dept. Res., Agrochem. Div., Sumitomo Chem. Ind. Co. Ltd., Osaka, Japan). **[Metabolism of ^{14}C-fenitrothion.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 84; 1973.* (Japanese)

In a study of residues and metabolism of fenitrothion, growing apples were dipped in a 0.1% emulsion of ^{14}C-methyl (on phenol moiety) fenitrothion and unlabeled fenitrothion. The disappearance of total ^{14}C was rapid; 52% of the applied amount disappeared within three days after treatment. With unlabeled fenitrothion the initial disappearance was also rapid. Residue levels of 4.35, 1.90, 1.12, 0.67, and 0.52 ppm, respectively, were found at 0, 3, 7, 14, and 21 days after treatment. Degradation of fenitrothion on the apple surface was relatively slow, about 80% of the ^{14}C on the surface remaining as fenitrothion after 21 days. The major metabolites were fenitroxon and *p*-nitrocresol. Fenitroxon reached a maximum of 0.02 ppm after three days. A very small amount of the *S*-isomer of fenitro-

thion was detected, which could have formed by irradiation, then oxidation by atmospheric oxygen. Fenitrothion degraded more rapidly within the fruits. However, no fenitroxon was found, and about 45% of the internal residue was present in the form of metabolites. A slow increase in water-soluble compounds was observed. A glycoside of *p*-nitrocresol was one of the major water-soluble metabolites. Desmethylfenitrothion was detected, but desmethylfenitroxon was not detected. Fenitrothion apparently disappeared by evaporation into the atmosphere while degradation by physicochemical factors proceeds on the apple surface. Hydrolytic cleavage of the P-O-C bond and conjugation of glucose with the phenol moiety occur within the fruit.

74-0171. Mihara, K.; Miyamoto, J. (Dept. Res., Agrochem. Div., Sumitomo Chem. Ind. Co., Ltd., Osaka, Japan). **[Metabolism of salithion, an organophosphorus insecticide, in animals and plants.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 85; 1973.* (Japanese)

Salithion, labeled with ^{14}C at the four position on the phosphorus-containing ring, was orally administered to rats. The excretion and distribution in the body after administration were traced autoradiographically, and the metabolites in urine and feces were examined by TLC. Salithion rapidly translocated to the internal organs of rats. The excretion of ^{14}C compounds was rapid: 90% was excreted via the urine in 24 hours. Almost no ^{14}C was detected in expired CO_2. Thin-layer chromatography of the urine revealed 15 metabolites, including demethyl-salithion as the major constituent. Similarly radiolabeled salithion was applied to *Phaseolus vulgaris* (bean) and rice plants by scattering on the surface of the water and by painting on the leaves. The root, the stem, and the leaves were separately extracted with methanol and chloroform. The condensed extract and the residue were analyzed for ^{14}C. Metabolites were identified by TLC. Salithion administered to bean and rice plants via root and leaf was absorbed rapidly; however, the evaporation of ^{14}C was high after foliar application. The greater part of the ^{14}C which remained in the plant was a glucose conjugate of saligenol. Other metabolites were the same as those found in rats. A proposed metabolic pathway of salithion was developed: (1) oxidation to salioxon, then demethylation, followed by P-ring cleavage; (2) demethylation followed by P-ring cleavage, then dephosphorylation to phenol which is conjugated with glucose (especially in plants); and (3) direct cleavage of the P-ring.

74-0172. Okawa, H.; Kohara, T.; Yoshihara, R.; Miyamoto, J. (Div. Res., Dept. Pestic. Enterprise, Sumitomo Chem. Ind. Co. Ltd., Osaka, Japan). **[Metabolism of *N*-methylcarbamate insecticides.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 86-87; 1973.* (Japanese)

The metabolism of an *N*-methylcarbamate insecticide, Tsumacide (MTMC) in mammals and plants, and that of another carbamate, Meobal, in plants was studied. More than 95% of the ^{14}C administered orally to male rats as ^{14}C-Tsumacide at 100 mg/kg was excreted in the urine within the first day after administration. Only 0.6% was excreted in the feces, and $^{14}CO_2$ was not detected. Excretion was slightly slower in female rats than in males. The urinary ^{14}C comprised 66% ether-soluble sutstances; the remainder was water-soluble. Of the ether-soluble substance, 60% was the *m*-carboxyphenyl product, and the remainder the *m*-hydroxymethylphenyl and 4-hydroxy-*m*-tolyl metabolites plus *m*-hydroxybenzoic acid and *m*-hydroxymethylphenol. The water-soluble portion yielded the above products after hydrolysis, indicating they were excreted in the urine as conjugates such as glucuronides or sulfates. Tsumacide was oxidized by microsomal oxidase in the liver in vitro to give primarily *m*-hydroxymethylphenyl and 4-hydroxy-*m*-tolyl-*N*-methylcarbamates. Labeled compounds applied to the upper surface of kidney bean leaves disappeared mainly by evaporation, leaving a minute amount of ^{14}C. Most of this was undegraded, but a trace was oxidatively metabolized. ChE inhibition by these metabolites was far lower than that of the original compounds.

74-0173. Smith, C. F. (Pfizer Lab., Ltd., Auckland, New Zealand). **Some aspects of the pharmacology of pyrantel.** *N. Z. Vet. J. 21: 52-53; 1973.* (1 reference)

A-Letter-to-the-Editor cites experimental evidence supporting the use of pyrantel in conjunction with cholinergic drugs and organophosphate exposure. Multiple therapeutic doses administered orally in horses have shown no effects on ChE levels. Pyrantel tartrate did not produce any effects on pigs when administered three days after 75 mg/kg dichlorvos, and simultaneous administration of pyrantel and trichlorfon or morantel and trichlorfon in horses indicated no incompatibility. Morantel and pyrantel at double the therapeutic dose did not interfere with atropine treatment of trichlorfon intoxication.

74-0174. Soedergren, A. (Dept. Anim. Ecol., Univ. Lund, S-223-62 Lund, Sweden). **Transport, distribution, and degradation of chlorinated hydrocarbon residues in aquatic model ecosystems.** *Oikos 24(1): 30-41; 1973.* (30 references)

Clophen A 50 (a polychlorinated biphenyl), *p,p'*-DDE, and *p,p'*-DDT were tested in a model aquatic ecosystem consisting of a primary producer unit (containing *Chlorella pyrenoidosa*), connected to separate compartments in which consumer organisms were kept. Each of the pesticides was taken up and transported mainly by the algae with very little distributed in the air and water. As much as 77% of the *p,p'*-DDE was found in the algae. Clophen A 50 and *p,p'*-DDT were apparently adsorbed to the walls of the system and/or

degraded since not all of the material was recovered. Algae did not degrade any of the compounds, but the lower chlorine-containing molecules of Clophen A 50 and *p,p'*-DDT were metabolized by higher organisms.

74-0175. Javaid, M. Y.; Waiz, A. (Dept. Zool., Univ. Punjab, Lahore, Pakistan). **Acute toxicity of five chlorinated hydrocarbon insecticides to the fish, *Channa punctatus*.** *Pak. J. Sci. Ind. Res. 15(4-5): 291-293; 1972.* (18 references)

TLm values of five organochlorines for the common fish, *Channa punctatus*, obtained with a 96-hr exposure, were 0.0019 ppm endrin, 0.0168 ppm dieldrin, 0.0214 ppm DDT, 0.0510 ppm aldrin, and 0.630 ppm BHC. The sequence of reactions to the various insecticide treatments was the same, and the length of each stage varied with concentration and toxicity of the chemical. Initially, fish became restless and highly sensitive to noise. This was followed in turn by a loss of sense of direction, loss of equilibrium, jerky movements, violent opening and closing of the mouth, landing on the bottom, and death. The fish became lighter in color and had swollen abdomens at the time of death. Those exposed to higher concentrations of endrin had bulging of the eyes.

74-0176. Miyamoto, J.; Suzuki, T. (Res. Dept., Pestic. Div., Sumitomo Chem. Co., Ltd., Takarazuka, Hyogo, Japan). **Metabolism of tetramethrin in houseflies in vivo.** *Pestic. Biochem. Physiol. 3(1): 30-41; 1973.* (19 references)

An acetone solution of radiolabeled tetramethrin was injected through the dorsal thorax of laboratory-reared flies at 0.5-2 μg/fly. Synergists were applied topically. Flies were killed by freezing, and each sample was analyzed for tetramethrin derivatives. The major radioactive metabolite derived from tetramethrin labeled on the alcohol moiety was *N*-(hydroxymethyl)3,4,5,6-tetrahydrophthalimide (MTI), amounting to 30-50% of the degraded products, followed by tetrahydrophthalimide (TPI). The most abundant metabolite from acid-labeled tetramethrin was chrysanthemumic acid, amounting to 20-40% of the degraded radioactivity. Oxidized tetramethrins and oxidation products of chrysanthemumic acid each accounted for about 10% of degraded material. The ratio of chrysanthemumic acid or MTI to the total metabolites was larger, the shorter the experimental period. When flies were sacrificed 15 min after injection of tetramethrin, nearly two thirds of the acid-labeled metabolite portion was identified as chrysanthemumic acid, and approximately one half of the metabolized alcohol-labeled tetramethrin was converted to MTI. Ether layers of the fly extracts in every tria' contained appreciable portions of unidentified radioactivity. Piperonyl butoxide had little effect on cleavage of the ester bond in tetramethrin, but another synergist, NIA 16388, remarkably inhibited this reaction.

74-0177. Tripathi, R. K.; Chiu, Y. C.; O'Brien, R. D. (Sect. Neurobiol. Behav., Div. Biol. Sci., Cornell Univ., Ithaca, NY 14850). **Reactivity in vitro toward substrate and inhibitors of acetylcholinesterase isozymes from electric eel electroplax and housefly brain.** *Pestic. Biochem. Physiol. 3(1): 55-60; 1973.* (33 references)

Polyacrylamide gel electrophoresis combined with specific substrate staining and gel scanning procedures was used to separate isozymes of acetylcholinesterase from electric eel (*Electrophorus electricus*) electroplax and housefly (*Musca domestica*) brain. In differential reactivity studies the Michaelis constant values for the five eel electroplax isozymes differed over a 2.4-fold range, and for the four housefly brain isozymes, over a 4.2-fold range. The variation ranges of the maximum velocity for the eel and fly isozymes were 2.2 and 2.7 fold. The kinetics of inhibition of AChE isozymes of eel and housefly by malaoxon, tetram, and eserine showed first order reaction rates. The isozymes differed over a 1.5-3-fold range in sensitivity to the inhibitors. Evidence for the fact that the various forms of AChE are true isozymes is provided by the fact that they are tissue specific and that they differ in reactivity to substrates and inhibitors. Housefly and eel AChEs are similar with respect to their reactivities with acetylthiocholine, malaoxon, and tetram whereas the housefly enzymes are about ten times more sensitive than those of the eel towards eserine.

74-0178. Terriere, L. C.; Yu, S. J. (Dept. Entomol., Oregon State Univ., Corvallis, OR 97331). **Insect juvenile hormones: induction of detoxifying enzymes in the housefly and detoxication by housefly enzymes.** *Pestic. Biochem. Physiol. 3(1): 96-107; 1973.* (21 references)

The cecropia juvenile hormone (JH), methoprene, hydroprene, 6,7-epoxy-3,7-diethyl-1-(3,4-(methylenedioxy)phenoxy)-2-octene (MDP-JH), and piperonyl butoxide were compared as inducers of microsomal enzymes. The compounds were fed to 1-day-old adult female flies for 3 days at up to 1% in the diet. Approximately a two-fold increase in the microsomal oxidases and a 50% increase in DDT dehydrochlorinase occurred after JH treatment. Methoprene increased (heptachlor) epoxidase activity by 30% but did not affect (*p*-nitroanisole) *O*-demethylase or (DDT) dehydrochlorinase. Hydroprene did not affect any of the enzyme systems while MDP-JH inhibited the two microsomal epoxidases. MDP-JH and piperonyl butoxide were strong inducers of DDT dehydrochlorinase, causing approximately two-fold increases in the activity of this enzyme. The microsomal preparations were able to metabolize methoprene and hydroprene. The effect was oxidative in the case of methoprene and both oxidative and hydrolytic in the case of hydroprene. The oxidative metabolism of these compounds was inducible by cecropia juvenile hormone as well as phenobarbital and dieldrin.

74-0179. Cooke, A. S.; Pollard, E. (Nature Conserv., Monks Wood Exp. Sta., Abbots Ripton, Huntington, England). **Shell and operculum formation by immature Roman snails *Helix pomatia* L. when treated with *p,p'*-DDT.** *Pestic. Biochem. Physiol. 3(3): 230-236; 1973.* (13 references)

Roman snails ingesting DDT at a rate of from 0.4 to 0.8 μg/wk from two weeks of age until hibernation produced less shell and operculum material when size factor was considered than control snails or snails treated at rates of 14 to 28 μg/wk or 570 to 1140 μg/wk. Control snails denied calcium supplement also exhibited reduced operculum and shell formation. Operculum formation was significantly delayed in controls denied calcium supplement and in DDT treated snails although the difference in this case was not significant. Residues of total DDT (DDT and TDE) ranged from 7.2 ppm in snails treated at the low dose of DDT to 160 ppm in snails treated at the high dose, indicating that as exposure became more severe, either intake was reduced or loss from tissues was increased. Differences in shell and operculum thickness between the groups may have resulted from an effect of DDT on growth of the snails or on differences in calcium intake since DDT may have increased calcium hunger. Snails collected from agricultural sites in the U.S. contained residues slightly lower than those of the low treatment group, suggesting that shell thinning could have occurred in snails from such localities.

74-0180. Rose, H. A.; Young, R. G. (Dept. Plant Pathol. Agr. Entomol., Univ. Sydney, N.S.W. 2006, Australia). **Nitroreductases in the Madagascar cockroach, *Gromphadorhina portentosa*.** *Pestic. Biochem. Physiol. 3(3): 243-252; 1973.* (42 references)

Nitroreductase activity in the Madagascar cockroach was found in the greatest amounts in the fat body although material of highest specific activity was found in the Malpighian tubules. All subcellular fractions tested contained nitroreductase activity; anaerobic conditions were necessary to detect such activity. Enzymes from the microsomal fraction required NADPH; enzymes from the soluble fraction required NADP. Sodium cyanide and *p*-chloro-mercuribenzoate inhibited the microsomal activity, as did the addition of a number of metal ions. Flavin (FMN) addition stimulated activity, and some activity was observed in the presence of FMN even after autoclaving the enzyme preparation. Subsequent experiments showed that FMN was the true substrate for nitroreductases and that the nitrobenzene, used to determine activity, was non-enzymatically reduced by $FMNH_2$.

74-0181. Wallnoefer, P. R.; Safe, S.; Hutzinger, O. (Bayerische Landesanstalt fuer Bodenkultur Pflanzenbau, Munich, Germany). **Microbial demethylation and debutynylation of four phenylurea herbicides.** *Pestic. Biochem. Physiol. 3(3): 253-258; 1973.* (14 references)

Metabolites of monuron, fluometuron, monolinuron, and buturon were detected in the culture medium in the late stage of the exponential growth phase of *Rhizopus japonicus*. Only small residues of the herbicides tested and no metabolites were found in the mycelium. After one week the fungus had converted more than half of the four herbicides to metabolic products. Mass spectral analysis of the metabolites showed that in the cases of monolinuron, monuron, and fluometuron, an *N*-methyl group was lost; with buturon the *N*-butyryl group was lost.

74-0182. Laanio, T. L.; Kearney, P. C.; Kaufman, D. D. (Ciba-Geigy Ltd., Basel, Switzerland). **Microbial metabolism of dinitramine.** *Pestic. Biochem. Physiol. 3(3): 271-277; 1973.* (10 references)

The metabolism of four structurally related dinitroaniline and dinitrodiamine herbicides by three species of fungi primarily involved dealkylation. Most of the starting materials and their metabolites were associated physically with *A. fumigatus* and *Paecilomyces* sp. cells, which grew in distinct mycelial pellets. *F. oxysporum*, which exhibited a yeast-like growth, retained very little herbicide and produced considerably more water-soluble material than the other organisms. A detailed study of dinitramine metabolism by *A. fumigatus* indicated two different degradation pathways: cleavage of the *N*-alkyl side chains, and formation of the benzimidazole derivative and its dealkylated product. A dinitramine-degrading enzyme system, dependent on NADPH and Fe++, was demonstrated in *A. fumigatus*.

74-0183. Still, G. G.; Mansager, E. R. (Agr. Res. Serv., U.S.D.A. Metab. Radiation Res. Lab., Fargo, ND 58102). **Metabolism of isopropyl carbanilate by soybean plants.** *Pestic. Biochem. Physiol. 3(3): 289-299; 1973.* (34 references)

Results of pulse time-course experiments indicate that propham-^{14}C is absorbed by soybean roots and translocated acropetally to the tissues present at the time of exposure to exogenous herbicide. Although a small concentration of radiocarbon was present in the seed pods, the fruit was free of detectable residue. No parent herbicide was found in any tissue examined three days after discontinuation of exposure, but polar products and nonextractable residues were found in roots, stems, and leaves. The aglycone derivative of isopropyl-2-hydroxycarbanilate, which was partially conjugated as a glycoside, was identified as the major product.

74-0184. Abernathy, C. O.; Ueda, K.; Engel, J. L.; Gaughan, L. C.; Casida, J. E. (Med. Serv. Lab., V.A. Hosp., Washington, DC 20422). **Substrate-specificity and toxicological significance of pyrethroid-hydrolyzing**

esterases of mouse liver microsomes. *Pestic. Biochem. Physiol. 3(3): 300-311; 1973.* (24 references)

LD50 values obtained for 19 pyrethroids in mice ranged from 10 mg/kg in the case of 5-benzyl-3-furylmethyl *cis*-ethanochrysanthemate to 1500 mg/kg in the case of 3-phenoxybenzyl esters of chrysanthemate and three other esters. Pretreatment with *S,S,S*-tributyl phosphorotrithioate (DEF), an esterase inhibitor, increased the toxicity of some of the pyrethroids to different degrees and did not alter the toxicity of others. Synergists like piperonyl butoxide also increased the toxicity of some of the insecticides. Mouse liver microsomal preparations hydrolyzed the cyclopropane carboxylate ester linkage of pyrethroid insecticides derived from primary alcohols. *Trans* isomers of such compounds were hydrolyzed more readily than the respective *cis* isomers and were also less toxic in mice. The toxicity of the pyrethroids in mice may be limited by the esterase or the mixed-function oxidase system, depending on the compounds involved.

74-0185. Chambers, J. E.; Yarbrough, J. D. (Dept. Zool., Mississippi State Univ., Mississippi State, MS 39762). **Organophosphate degradation by insecticide-resistant and susceptible populations of mosquitofish (*Gambusia affinis*).** *Pestic. Biochem. Physiol. 3(3): 312-316; 1973.* (14 references)

Populations of mosquitofish which were organochlorine-resistant had high levels of liver mixed-function oxidase activity on parathion and methyl parathion that corresponded to high levels of tolerance to parathion and methyl parathion. GSH-dependent nonoxidative enzymes were not evident in preparations from resistant or susceptible fish. Phosphate degradation was usually lower in resistant than in susceptible fish, suggesting that this is not the mechanism involved in tolerance to parathion and methyl parathion. The difference observed in the rate of degradation of paraoxon and methyl paraoxon could, however, account in part for the greater tolerance of the fish for methyl parathion.

74-0186. Wright, M. A.; Stringer, A. (Long Ashton Res. Sta., Univ. Bristol, Bristol, BS18 9AF, England). **The toxicity of thiabendazole, benomyl, methyl benzimidazol-2-yl carbamate and thiophanate-methyl to the earthworm, *Lumbricus terrestris*.** *Pestic. Sci. 4(3): 431-432; 1973.* (2 references)

Previous studies showed that earthworm populations were reduced in soil treated with benomyl or thiophanate. Captive worms would not feed on leaf material sprayed at 0.75 $\mu g/cm^2$ with benomyl, methylbenzimidazole-2-yl carbamate (MBC), or thiophanate-methyl, and they were killed following contact with benomyl in aqueous suspensions or soil drenches. Thiabendazole on leaves at 7 $\mu g/cm^2$ did not inhibit feeding; earthworms were killed in 6 days, after ingesting ca. 25 μg thiabendazole per worm. Thiabendazole, thiophanate-methyl, and MBC are also toxic by contact. Worms immersed for 1 min. in 0.5% aqueous suspensions were killed within 14 days, and soil drenches at a rate of 0.78 $\mu g/m^2$ gave 100% kill in 18 days for worms confined in pots of this soil. It was originally suggested that the toxicity of benomyl might be due to anticholinesterase activity of the carbamate moiety. During in vitro assays benomyl at 7 μg/ml inhibited horse serum cholinesterase activity by 50%, and thiabendazole at the same level gave 25% inhibition. MBC and thiophanate-methyl had no effect. Cerebral ganglion cholinesterase from *L. terrestris* behaves similarly to horse serum cholinesterase. Therefore if the investigated compounds have a common mode of toxic action in the earthworm, it probably is not dependent on cholinesterase inhibition.

74-0187. Reznikov, A. G. (Kiev Sci. Res. Inst. Endocrinol. Metab., Min. Pub. Health Ukr. SSR, Kiev, USSR). **Eksperimental'nyye dannyye ob adrenokortikoliticheskoy aktivnosti *m,p'*-dikhlordifenildikhloretana i *p,p'*-dietildifenildikhloretana. [Experimental data on adrenocorticolytic activity of *m,p'*-DDD and *p,p'*-perthane.]** *Probl. Endokrinol. 19:71-74; 1973.* (12 references) (Russian)

The adrenocorticolytic activity of *m,p'*-DDD and *p,p'*-perthane was studied in adult dogs and chicks. The dogs were fed 10 or 25 mg/kg of *m,p'*-DDD or *p,p'*-perthane daily for 8 to 21 days; chicks were given i.v. injections at 100 mg/kg daily for 10 days. The functional status of the adrenal cortex was evaluated based on the plasma hydrocortisone level and its reaction to i.v. administration of 20 units of ACTH. Hydrocortisone levels of the venous and peripheral blood plasma decreased and the response to ACTH was depressed after 25 mg/kg of *p,p'*-perthane or *m,p'*-DDD in dogs. Focal degeneration of cortical cells and accumulation of lymphoid cells were seen after *m,p'*-DDD, and more emphatically after *p,p'*-perthane. The preparations did not cause morphological changes in the adrenal gland; when given at 10 mg/kg to dogs for three weeks, or at 100 mg/kg to chicks for 10 days, they did not change the adrenocortical hormone production or cortical structure. The adrenocorticolytic activity of *m,p'*-DDD was significantly inferior to that of *p,p'*-perthane and *o,p'*-DDD. The action of *p,p'*-perthane on the adrenal cortex resembled that of *o,p'*-DDD.

74-0188. Ruber, E. (Dept. Biol., Northeastern Univ., Boston, MA 02115). **Primary producers, pesticides and pyramids.** *Proc. 58th Annu. Meeting New Jersey Mosquito Extermination Ass., 1971, pp. 162-174.* (14 references)

A review of various investigations of the effects of pesticides on phytoplankters shows that species are differentially susceptible and that these compounds are not equally toxic. Utilizing optical density as a measure

of population growth, carbaryl and DDT were more toxic than lindane to five algae. Uptake of ^{14}C was inhibited by concentrations of DDT as low as 10 ppb although the stress of a sealed container was also present in this experiment. The organophosphates, Baygon (propoxur), Baytex (fenthion), and abate, also limited growth or photosynthesis. Measurement of DDT residues in phytoplankton samples taken between 1955 and 1969 indicates an increase in uptake in the later years. Although these findings do not suggest a possible elimination of our oxygen supply, which is partially maintained by these plankton, their consequences in terms of concentration of residues in higher animals and reduced diversification should be viewed with concern. Application of pesticides must be limited to effective and necessary concentrations of the least objectionable materials.

74-0189. Kaiser, T. O.; Dunham, J. (Dept. Zool. Entomol., Iowa State Univ., Ames, IA). **The absorption of chlorinated hydrocarbon insecticides by frog skin.** *Proc. Iowa Acad. Sci. 79(3-4): 101-104; 1972.* (6 references)

Lindane, dieldrin, aldrin, heptachlor, and *p,p'*-DDT were absorbed in decreasing amounts from Ringer's solution or water by frog skin. The rates of accumulation in the skin were related to the water solubility of the pesticides; i.e., those with the highest water solubility were accumulated at the fastest rate. Lindane moved at rates of 0.691 ppb/hr through live isolated frog skin and 0.666 ppb/hr through dead isolated frog skin. The difference was not significant since there was some variation between skins. No movement of heptachlor was observed with either live or dead skin during the period of the experiment. Although large quantities of these pesticides may be distributed in the environment, their limited solubility probably restricts the rate of accumulation in certain biota.

74-0190. Anderson, P. D.; Weber, L. J. (Dept. Fish. Wildlife, Oregon State Univ., Corvallis, OR 97331). **The quantitative relationship between body size and lethal response of a teleost exposed to environmental toxicants.** *Proc. West. Pharmacol. Soc. 16: 139-140; 1973.*

Excellent linear correlation was obtained between the log of the mean daily concentration of dieldrin, potassium pentachlorophenate, potassium cyanide, or the chlorides of copper, nickel, and zinc and the percent lethal response of mature male guppies exposed to these toxicants in 96-hr bioassays. Linear correlation between concentration and response was poor when fish of different weights were used. Excellent correlation could be achieved by introducing on the abscissa the log of the kth power of the formulation C/W, where C equals concentration, W equals weight of each lot of fish, and k is a weighting exponent with a value between 0 and 1. The exponents k which gave the "best fit" were 0.81 for dieldrin and 0.72 for potassium pentachlorophenate and potassium cyanide. .

74-0191. Talens, G.; Woolley, D. (Dept. Environ. Toxicol., Univ. California, Davis, CA 95616). **Effects of parathion administration during gestation in the rat on development of the young.** *Proc. West. Pharmacol. Soc. 16: 141-145; 1973.* (5 references)

The effects of parathion on development of the young were studied after injection of pregnant rats with 1.5 or 2.0 mg/kg of the pesticide for four days beginning on days 1, 7, or 13 of gestation. In preliminary experiments this regimen resulted in appearance of symptoms four hours after the last dose and disappearance of symptoms three days after the last dose although brain AChE levels were depressed for one week. Symptoms of parathion poisoning were most severe, and sometimes fatal, in pregnant rats treated in the last trimester. The only stillborn pups were born to animals in this group. A significantly greater number of pups from treated mothers died or were missing within two weeks of birth than from controls. Birth weights and certain reflexes were lower in pups from treated animals, but brain AChE activity was normal. A slower growth rate and retarded reflexes observed in pups from treated groups may have resulted from abnormal behavior of the mothers.

74-0192. Borghi, H.; Puiseux-Dao, S.; Bonotto, S.; Hoursiangou-Neubrun, D. (Lab. Biol. Cellulaire Vegetale, Univ. Paris VII, F-75005 Paris, France). **The effects of lindane on *Acetabularia mediterranea*.** *Protoplasma 78(1-2): 99-112; 1973.* (6 references)

Lindane treatment of adult cells of *Acetabularia mediterranea* reversibly inhibited cell regeneration to different degrees depending on concentrations (5 to 60 μg/ml) and time of exposure (2 to 28 days). A time dependent retardation of cap morphogenesis also occurred with lindane exposure although the rate of growth and cap formation were normal. Cell development was delayed during exposure to a concentration of 10 μg/ml, and algae degenerated after slight growth in 30 μg/ml. General metabolism, measured by thymidine, uridine, and leucine incorporation in the TCA insoluble fraction, was inhibited to a greater extent in younger cells and with higher levels of exposure. Basal parts treated with 60μg/ml lindane for eight days exhibited some alterations in plastid ultrastructure.

74-0193. Koshakji, R. P.; Cole, J.; Harbison, R. D. (Cent. Toxicol., Vanderbilt Med. Cent., Nashville, TN). **Influence of injection volume on parathion toxicity and plasma and brain cholinesterase inhibition.** *Res. Comm. Chem. Pathol. Pharmacol. 6(2): 677-687; 1973.* (6 references)

Cholinesterase inhibition and lethality induced by parathion in adult female and newborn rats and female mice were significantly greater with an injection volume (corn oil) of 0.01 ml/10 g than with a volume of 0.1 ml/10 g. Plasma ChE activities in newborn rats 4 hr after

administration of 1 mg/kg parathion were: control 0.751 μ moles/ml/min; low volume, 0.166 μ moles/ml/min; and high volume, 0.513 μ moles/ml/min. Significant differences were also observed with brain ChE activities and at doses of 2 and 8 mg/kg parathion. Administration of parathion at 12 mg/kg to mice resulted in a 50% lower ChE level in plasma and brain when the injection volume was 0.01 ml/10 g instead of 0.1 ml/10 g. While 65% of the mice died within 3 hr after injection with a low volume, only 5% died in the same period after injection with the high volume. All of the newborn rats treated with parathion at 1.5 and 2.0 mg/kg in the low volume died within 3 hr, but only 20% died in 4 hr after the same doses in a high volume. At the lower doses total deaths were significantly greater with smaller injection volumes. Duplication of toxicity data between laboratories would thus require use of the same conditions of injection in addition to other normally considered variables.

74-0194. Deaciuc, I. V.; Frecus, G. (Biol. Res. Cent., Lab. Anim. Physiol., Cluj, Rumania). **Effects of monofluoroacetate on the concentration of some metabolites in resting and stimulated skeletal muscle and in liver of the rat in vivo.** *Rev. Roum. Biochim. 10(3): 171-177; 1973.* (28 references)

Stimulated and resting leg muscles in female rats examined about two hours after administration of monofluoroacetate (MFA) at 10 mg/kg had an increased glucose 6-phosphate content and an increased lactate content. ATP, ADP, Pi, creatine phosphate, and glycogen did not change in treated animals. In liver of treated animals, changes were not measured in ATP, ADP, Pi, or glucose 6-phosphate content. The results are discussed in regard to the regulation of phosphofructokinase activity by citrate.

74-0195. Vilceanu, R.; Chiriac, A.; Szabaday, Z.; Simon, Z. (Chem. Res. Cent., Timisoara, Rumania). **Multiple correlations in the anticholinesterazic activity of organic phosphorus compounds.** *Rev. Roum. Biochim. 10(3): 239-252; 1973.* (11 references)

Structure-activity relationships for 49 organophosphates of the general type $R_1R_2P(O)OR_3$ were investigated using LD50 in mice and the following structural parameters for the $R_1 + R_2$ and R_3 groups: Hammett constants, number of atoms with lone electron pairs (for hydrogen bonding), hydrophobic increment, number of aromatic cycles, and electron accepting character for charge transfer complexes. Although the compounds differ in steric structural parameters like the Hammett constants, regression equations yielded a correlation coefficient of 0.66 in the case of the linear one and 0.86 in the case of the quadratic one. The least toxic compounds had all benzene groups in R_3 and low substituent constant values. The R_3 group did not have aromatic cycles and had $\sigma = 3.08$ in highly toxic compounds, and a lower number of atoms with lone electron pairs favored toxicity.

74-0196. Malmqvist, E.; Grossmann, G.; Ivemark, B.; Robertson, B. (Dept. Pediatr. Pathol., Karolinska Sjukhuset, S-104 01 Stockholm 60, Sweden). **Pulmonary phospholipids and surface properties of alveolar wash in experimental paraquat poisoning.** *Scand. J. Resp. Dis. 54(4): 206-214; 1973.* (28 references)

Analysis of the phospholipid composition of lung homogenates and alveolar wash by TLC revealed a significant reduction of the lecithin fraction in both when rats were subcutaneously injected with paraquat at 35 mg/kg 24 hr prior to sacrifice. Lung homogenates from treated animals contained approximately 30% less total lecithin than control homogenates. Total lecithin was reduced 75% and lecithin concentration 50% in alveolar wash from treated rats; protein content of the wash increased 4-fold in the treated rats. Wilhelmy balance recordings in treated animals exhibited a much narrower hysteresis loop than in control animals. The results suggest that paraquat interferes with the phospholipid metabolism of the alveolar epithelium, causing a deficiency of surfactant molecules in the alveolar lining layer and eventual alveolar collapse.

74-0197. Wakeling, A. E.; Visek, W. J. (Dept. Anim. Sci., Cornell Univ., Ithaca, NY 14850). **Insecticide inhibition of α-dihydrotestosterone binding in the rat ventral prostate.** *Science 181(4100): 659-661; 1973.* (26 references)

Labeled *o,p'*-DDT and dieldrin were bound to the same fraction in prostate cytosols as the sex steroid hormone 5α-androstan-17β-ol-3-one (5α-DHT). Both compounds strongly inhibited binding of 5α-DHT in the nonspecific binding region (3.5*S*) at concentrations in the range of 5 to 15 ppm. DDT, but not dieldrin, inhibited the binding of 5α-DHT to the 8*S* specific prostate cytosol fraction. In the presence of a saturating concentration of the hormone, 10 ppm *p,p'*-DDT inhibited binding 60.7%. Dieldrin reduced the available receptor of this fraction when the concentration of 5α-DHT was reduced. The results indicated noncompetitive inhibition, which could be due to a conformational change of the receptor protein induced by the insecticides, and suggest a possible biochemical mechanism by which hormonal action in mammalian reproductive organs is modified.

74-0198. Kuba, K.; Albuquerque, E. X.; Barnard, E. A. (Dept. Pharmacol. Sch. Med. Dent., State Univ. of New York at Buffalo, Buffalo, NY 14214). **Diisopropylfluorophosphate: suppression of ionic conductance of the cholinergic receptor.** *Science 181(4102): 853-855; 1973.* (15 references)

When frog sartorius muscles were exposed to

diisopropylfluorophosphate, the amplitude and half-decay time of the end-plate current decreased; the half-decay time became almost potential-independent and the equilibrium potential for the end-plate current was more negative than during control conditions. When the excess reagent was removed by washing so that only the phosphorylated acetylcholinesterase remained, the amplitude of the end-plate current was restored, while its half-decay time was markedly increased. These findings reveal that this organophosphate significantly affects the receptor-ionic conductance modulator complex in addition to its well-known anticholinesterase activity. (Author abstract by permission. Copyright 1973 by the American Association for the Advancement of Science.)

74-0199. Kimbrough, R. D. (Bioeffects Branch, Environ. Protect. Agency, Chamblee, GA 30341). **Malignant tumors in monkeys.** *Science 181(4104): 995; 1973.* (1 reference)

Reference made to a spontaneous malignant gastric tumor in a rhesus monkey exposed during its life to DDT and demeton was clarified in a Letter-to-the-Editor. Since only one out of eight monkeys exposed to these pesticides developed a tumor and since the monkeys had also been exposed to poliomyelitis and alcohol treatment, no correlation between pesticide administration and tumor development could be made. Such lesions must be considered spontaneous unless controlled studies with more animals indicate contrary conclusions.

74-0200. Yasuda, M.; Maeda, H. (Sch. Anat., Kyoto Prefect. Univ. of Med., Kyoto, Japan). **[Significance of the lumbar rib as an indicator in teratogenicity tests.]** *Senten Ijo (Congenital Anomalies) 13(1): 25-29; 1973.* (13 references) (Japanese)

Approximately 20 kinds of chemical compounds were tested for teratogenicity. Three of these, Vitamin A (intraperitoneal admin.), a phenoxyacetic acid herbicide (oral admin.), and a tetracycline derivative (oral admin.) showed a correlation between the dose level, the frequency of lumbar rib, and the teratogenicity. Pregnant Wistar rats fed a daily diet containing 0, 40, 500, 1000, or 2000 ppm of a phenoxyacetic herbicide continuously from the eighth to the fifteenth day of pregnancy had fetal lumbar rib frequencies of 20, 20, 40, 42, and 78%. The frequency of congenital malformations such as cleft palate, vertebral fusion, ventricular septal defect, and renal malformation was 1, 2, 0, 7, and 31% respectively. The teratogenicity of the herbicide was clearly apparent at the 200 ppm rate. The frequency of lumbar rib was significantly higher than in the controls, even at a lower rate than the teratogenic threshold. At 500 ppm the frequency of lumbar rib was about two times greater than in the controls.

74-0201. Lech, J. J.; Pepple, S.; Anderson, M. (Dept. of Pharmacol., Med. Coll. of Wisconsin, Milwaukee, WI 53233). **Effects of novobiocin on the acute toxicity, metabolism and biliary excretion of 3-trifluoromethyl-4-nitrophenol in rainbow trout.** *Toxicol. Appl. Pharmacol. 25(4): 542-552; 1973.* (15 references)

This report is concerned with the effects of novobiocin on the acute toxicity and disposition of 3-trifluoromethyl-4-nitrophenol (TFM) in rainbow trout. Pretreatment of rainbow trout with 200 mg/kg novobiocin ip decreased the 3-hr LC50 of TFM from 5.20 to 2.48 mg/liter. Temporally associated with the increase in toxicity was an elevation of ^{14}C in blood of novobiocin-treated trout exposed to [^{14}C]TFM in the tank water. Analysis of blood, brain, and liver revealed increased concentrations of unconjugated TFM in these tissues from novobiocin-pretreated trout. Novobiocin also increased the half-life of TFM in blood when TFM was injected ip. In addition, novobiocin pretreatment resulted in a sharp decrease in biliary excretion of TFM glucuronide and an increase in the blood concentrations of TFM glucuronide when [^{14}C]TFM was given by ip injection or by exposure in the tank water. The results are discussed in relation to the importance of conjugation and biliary excretion in the protection of trout from toxic phenols in water. (Author abstract by permission)

74-0202. Satoh, T.; Moroi, K. (Dept. of Pharmacol. and Toxicol., Inst. of Food Microbiol., Chiba Univ., Chiba, Japan). **Comparative studies on the inhibition of liver amidases, aminopeptidase and serum cholinesterases by EPN.** *Toxicol. Appl. Pharmacol. 25(4): 553-559; 1973.* (15 references)

The hydrolysis of isocarboxazid, a monoamine oxidase inhibitor, by rat liver homogenate was inhibited after treatment of rats with EPN at doses below those which inhibited serum cholinesterase. After single doses of EPN (5-15 mg/kg), almost complete inhibition of isocarboxazid amidase occurred sooner, and persisted longer, than cholinesterase inhibition. Tissue monoamine oxidase inhibition by isocarboxazid was reduced by pretreatment with EPN in rats. Administration of EPN for three consecutive days at lower doses (0.5-2.5 mg/kg) caused no inhibition of cholinesterase but produced a small, consistent inhibition of liver isocarboxazid amidase. In this study the liver isocarboxazid amidase was shown to be a more sensitive indicator of exposure to EPN intoxication than serum cholinesterase inhibition. (Author abstract by permission)

74-0203. Natoff, I. L.; Reiff, B. (Shell Res. Ltd., Tunstall Lab., Sittingbourne, Kent, England). **Effect of oximes on the acute toxicity of anticholinesterase carbamates.** *Toxicol. Appl. Pharmacol. 25(4): 569-575; 1973.* (17 references)

The acute toxicities of eight anticholinesterase carbamates were determined in male rats by sc injection, both in the absence and in the presence of therapeutically administered atropine sulfate or pyridinium oximes. Atropine reduced the toxicities of all carbamates; and the oximes,obidoxime and P2S, when used in combination with atropine, generally enhanced the therapeutic efficiency of atropine. When used alone, the oximes also reduced the toxicity of carbamates by varying degrees. However, an exception was seen in the case of carbaryl. Here, the therapeutic administration of oximes markedly increased the toxicity, and when used in combination with atropine, obidoxime markedly reduced the protection afforded by the alkaloid. The influence of obidoxime and P2S on the inhibition of cholinesterase in vitro by the carbamates was measured, and it was found that they influenced the anticholinesterase activity of the carbamates in a pattern similar to their effect on the toxicity of the carbamates. It is concluded that a causal relationship exists between the toxicity of carbamates and factors affecting their anticholinesterase activity. The increased toxicity and the anticholinesterase activity of carbaryl in the presence of the oximes are unique to this carbamate among those studied. (Author abstract by permission)

74-0204. Reiter, L.; Talens, G.; Woolley, D. (Dept. of Environ. Toxicol. and Animal Physiol., Univ. of California, Davis, CA 95616). **Acute and subacute parathion treatment: effects on cholinesterase activities and learning in mice.** *Toxicol. Appl. Pharmacol. 25(4): 582-588; 1973.* (13 references)

The effects of parathion, an organophosphate insecticide, on the learning and memory of a one-trial, passive-avoidance task and on blood and brain true cholinesterase (AChE) and pseudocholinesterase (ChE) activities were tested in mice. An acute dose of 6 mg/kg po was given to mice at various times either prior to the learning trial or the retest trial 24 hr later. A second group of animals was used to determine blood and brain AChE and ChE activities following parathion administration. In another study, various doses (1-4 mg/kg) of parathion were administered sc to mice for 6 days prior to the learning trial. The results of acute administration indicate that parathion given before the learning trial is effective in blocking learning. The maximum effect occurs when parathion is given within the first hour before the learning trial and correlates with maximum changes in enzyme activities. Subacute treatment with parathion results in marked depression in AChE and ChE activities, yet has no effect on learning. These results indicate that parathion disrupts learning upon acute exposure, but that compensation occurs to the prolonged depression of AChE. (Author abstract by permission)

74-0205. Kennedy, G. L., Jr.; Frawley, J. P.; Calandra, J. C. (Ind. Bio-Test Lab., Inc., Northbrook, IL 60062). **Multigeneration reproductive effects of three pesticides in rats.** *Toxicol. Appl. Pharmacol. 25(4): 589-596; 1973.* (9 references)

Administration of Delnav (dioxathion) to three successive generations of albino rats at dietary levels of 3 to 10 ppm caused no measurable abnormalities among either parental animals or their progeny. Toxaphene at dietary levels of 25 and 100 ppm exerted no effects on litter size, pup survival, or weanling body weights, but parental animals at 100 ppm showed liver changes consisting of slight cytoplasmic fatty vacuolization. This change was not observed at 25 ppm and was not accompanied by adverse effects on growth, mortality, clinical parameters, organ weight, or reproductive capacity. Herban (norea) at 500 ppm produced no abnormalities among parental animals or their progeny, but at a level of 3000 ppm, growth of parental animals was slightly depressed; increases in absolute liver weight and in the liver-to-body weight ratios were observed. The growth depression was attributed to unpalatability of the test diet. No other parameter was adversely affected except for a slight depression in weanling body weights which did not persist beyond the first litter of the second generation. No-effect levels are judged to be 10, 25, and 500 ppm for Delnav, toxaphene, and Herban, respectively. Reproduction was not affected at levels of 10, 100, and 3000 ppm of Delnav, toxaphene, and Herban, respectively. (Author abstract by permission)

74-0206. Shah, P. V.; Guthrie, F. E. (Dept. Entomol., North Carolina State Univ., Raleigh, NC 27607). **Penetration of insecticides through isolated sections of the mouse digestive system: effects of age and region of the intestine.** *Toxicol. Appl. Pharmacol. 25(4): 621-624; 1973.* (9 references)

Penetration of five insecticides through various intestinal sections was studied in a closed in vitro system. Washed 4-cm intestinal sections were suspended in phosphate buffer at 30°C in a centrifuge tube. Radiolabeled insecticide solutions were introduced from the top. After 80 min the amount of radioactivity in the serosal and luminal solutions and remaining on the tissues was determined. In 6-week-old mice malathion and carbaryl penetrated through colon more rapidly than through small intestine or rectum. Penetration was more rapid through the rectum than the small intestine for malathion and dimethoate. Penetration of DDT and dieldrin did not differ among the three areas. Association with the tissue component varied with the section for carbaryl and dimethoate, but not for malathion, DDT, and dieldrin. The differences in penetration according to age group (12 days, 6 weeks, and 12 weeks) were trivial for carbaryl, DDT, and dieldrin, but malathion and dimethoate penetrated more rapidly through the tissues of the unweaned mice. The amount of insecticide bound to the gut tissues was greater in the older mice except in the case of the chlorinated hydrocarbons.

74-0207. Budreau, C. H.; Singh, R. P. (Dept. of Anatomy, Univ. of Western Ontario, London, Ontario, Canada). **Effect of fenthion and dimethoate on reproduction in the mouse.** *Toxicol. Appl. Pharmacol. 26(1): 29-38; 1973.* (16 references)

Five generations of CD-1 mice were maintained on a diet containing 60 ppm fenthion or dimethoate in drinking water. Reproductive performance, lactation, viability and growth rate of the young, and histologic changes in adult organs were studied. Dimethoate treatment significantly altered reproductive performance as indicated by reduced mating success and longer reproduction time. At birth, litter size or weight were not reduced, but pup mortality increased significantly with treatment. Growth rate of the pups was generally lower than that observed for controls. In the parameters studied, fenthion treatment was not as detrimental as dimethoate, its main effect being a significant increase in pup mortality. Neither compound showed teratologic potential or adverse effects on organ weight or histology at the dose studied. (Author abstract by permission)

74-0208. Carson, V. G.; Jenden, D. J.; Russell, R. W. (Dept. of Pharmacol., UCLA Sch. of Med., Los Angeles, CA). **Changes in peripheral cholinergic systems following development of tolerance to the anticholinesterase diisopropylfluorophosphate.** *Toxicol. Appl. Pharmacol. 26(1): 39-48; 1973.* (23 references)

Biochemical changes in peripheral cholinergic systems were analyzed to see whether any correlations could be found between these changes and the development of behavioral tolerance to repeated injections of DFP. Cholinesterase activities after DFP treatment (expressed as percent of control activities) were 24% in the brain, 25% in plasma and erythrocytes, 65% in the diaphragm, and 85% in the ileum. All these activities remained the same through 22 days of DFP treatment. Pharmacologic evidence of tolerance was seen in the ileum at 22 days. This evidence consisted of the return to normal sensitivity to ACh and the development of subsensitivity to carbachol. Morphine (50 μg/ml) reduced the ACh sensitivity of ileal strips from control and pretolerant rats but increased that of ileal strips from tolerant rats. These morphine data suggest that the mechanism of tolerance may be found in the activation of an ACh reuptake system. Possible evidence of pharmacologic tolerance was also seen in the phrenic nerve-diaphragm preparation. A trend of subsensitivity to *d*-tubocurarine developed in 1 through 10 days of DFP treatment and disappeared on day 22. (Author abstract by permission)

74-0209. Gaines, T. B.; Kimbrough, R. D.; Linder, R. E. (Bio-Effects Branch, Primate and Pestic. Effects Lab., Environ. Protect. Agency, Chamblee, GA 30341). **The toxicity of amitrole in the rat.** *Toxicol. Appl. Pharmacol. 26(1): 118-129; 1973.* (10 references)

A single oral dose of 4080 mg/kg and a single dermal dose of 2500 mg/kg of amitrole, the highest doses given, were not lethal to adult rats. Dietary levels of 0, 1000, 500, 100 and 25 ppm amitrole were fed to groups of 10 male and 10 or 12 female rats. The dietary levels of 1000 and 500 ppm were fed for 107-110 days, the dietary levels of 100 and 25 ppm for 240-247 days to the F_0 generation and for 141 days to the F_{16} generation. At the dietary levels of 1000 and 500 ppm the pups that were born were smaller and had atrophic thymuses and spleens indicative of runt disease. Most of them had died within a week after weaning. Reproduction was not affected at the lower dietary levels. Hyperplasia of the thyroid was seen in all rats fed dietary levels of 100 ppm or greater. In the 25 ppm group 4/10 F(O) and 4/10 F(1b) females and 6/10 F(1b) males, but none of the F(O) males developed hyperplasia of the thyroid. (Author abstract by permission)

74-0210. Schafer, E. W., Jr.; Brunton, R. B.; Lockyer, N. F.; De Grazio, J. W. (Wildl. Res. Cent., Bur. of Sport Fish. and Wildl., U. S. Dept. of the Interior, Denver, CO 80225). **Comparative toxicity of seventeen pesticides to the *Quelea*, house sparrow, and red-winged blackbird.** *Toxicol. Appl. Pharmacol. 26(1): 154-157; 1973.* (6 references)

The acute po LD50 values of 17 commercial or experimental pesticides were determined for quelea (*Quelea quelea*), house sparrows (*Passer domesticus*), and red-winged blackbirds (*Agelaius phoeniceus*), and the acute dermal LD50 values for quelea and house sparrows. Close correlations suggested that po toxicity data for red-winged blackbirds and dermal toxicity data for house sparrows can be used as preliminary indicators of po and dermal toxicity to quelea, respectively. (Author abstract by permission)

See also 74-0005 74-0010 74-0051 74-0052 74-0062 74-0067 74-0079 74-0084 74-0213 74-0220 74-0252

74-0211. Himel, C. M.; Mayer, R. T.; Chan, L. M. (Dept. Entomol. Univ. Georgia, Athens, GA). **Cholinesterase-fluorescent probe complexes in the bioassay of insecticides.** *Amer. Chem. Soc. Div. Water Air Waste Chem. 11(2): 125-127; 1971.*

Since insecticides may compete with the equilibrium fluorescent probe, 1-(5-dimethylaminonaphthalene-1-sulfonamido)3-*N*,*N*-dimethylaminopropane (TA), for active and hydrophobic sites of ChE, fluorescence emission of ChE-TA complexes can be used as an indicator of insecticide level. Dursban (chlorpyrifos), a phosphate-type insecticide, decreased fluorescence over the range of 0.1 to $3 \times 10^{-6} M$ at TA concentrations from 2 to $12 \times 10^{-7} M$. Thiodan, a chlorinated diene-type insecticide, produced a less marked decrease in fluorescence over the same range. Chlorinated hydrocarbons do not affect the kinetics of reaction of ChE at the active site, and their interaction with ChE at hydrophobic sites is a new finding.

74-0212. Wheeler, L.; Strother, A. (Dept. Pharmacol., School Med., Loma Linda Univ., Loma Linda, CA 92354). **Comparison of NCS solubilization and a wet combustion technique for ^{14}C measurement in dried biological tissues.** *Anal. Biochem. 53(1): 42-48; 1973.* (11 references)

NCS solubilization of dried rat tissues was reliable for determining ^{14}C-carbaryl when sufficient cpm were present, and was much less time-consuming than a modification of the Van Slyke wet combustion method. Recoveries of ring-labeled and carbonyl-labeled carbaryl after a 4-hr incubation with NCS at 50° were 94% and 101%, respectively. Efficiencies varied according to the tissue involved from 19 to 48%. Much higher counting efficiencies could be obtained and more tissue could be used in the wet combustion method, but 18 to 20 minutes was required to combust each sample. Recovery of ^{14}C from labeled carbaryl was 99.7%. Highest dpm/g tissue recovered from rats treated with carbaryl was found in liver and kidney.

74-0213. Davis, J. E.; Cranmer, M. F.; Peoples, A. J. (Environ. Protection Agency, Perrine Primate Lab., Perrine, FL 33157). **Gas-liquid chromatography of parathion metabolites as a sensitive index of induction of liver microsomal mixed-function oxidases.** *Anal. Biochem. 53(2): 522-530; 1973.* (11 references)

A sensitive, reproducible method which uses the in vitro metabolism of parathion was developed for determining the induction of liver microsomal mixed-function oxidases. Microsomal preparations from test animals were incubated with parathion after EDTA was added to prevent the formation of diethyl phosphate. Ethyl acetate extracts of the mixture were chromatographed on a MicroTek MT-220 GC equipped with a flame photometric detector using a column of 3% OV-1 on Gas Chrom Q. To measure diethyl phosphate (DEP) and diethylthiophosphate (DETP) produced in a similar system the aqueous mixture was acidified and extracted with acetonitrile for GC. Recoveries from various combinations of parathion and metabolites were 102%, 88.9%, 74.8%, and 90.8%, respectively, for parathion, paraoxon, DEP, and DETP. During a comparison of various indices of induction, no significant differences in activity of mixed function oxidases could be detected in DDT- and DDE-pretreated animals except when the conversion of parathion to paraoxon was used as the assay system.

74-0214. Cranmer, M. F.; Peoples, A. J.; (Nat. Cent. Toxicol. Res., Jefferson, AR 72079). **Determination of trace quantities of anticholinesterase pesticides.** *Anal. Biochem. 55(1): 255-265; 1973.* (8 references)

A method for screening large numbers of samples for anti-ChE activity has been developed. The method is based on the GC determination of 3,3-dimethylbutanol (DMB) formed from 3,3-dimethylbutylacetate in the presence of AChE. The substrate was chosen for its low nonenzymatic hydrolysis, solubility in a solvent of low hydrogen flame response, equal substrate to enzyme affinity, and the satisfactory chromatographic characteristics of both the substrate and the product. A variety of inhibitors were dissolved in water and ethylene glycol and incubated in the system for 60 minutes. DMB was extracted into CS_2 and injected onto a MicroTek MT-220 GC equipped with a single hydrogen flame ionization detector. In order to determine levels of compounds which require activation, such as parathion, samples were treated with 1 part of a 0.2% bromine water solution to 10 parts of sample solution for one hour at 37° and then incubated in the enzyme system. The method was sensitive enough to detect ChE inhibition due to as little as 30 ppt paraoxon, 3 ppb malaoxon, or 2 ppm carbaryl.

74-0215. Harris, L. E. (Anal. Qual. Contr. Lab., Nat. Environ. Res. Cent., U. S. Environ. Protect. Agency, Cincinnati, OH 45268). **GC/MS computer system for identification of organic pollutants in water.** *Anal. Instrum. 11: 183-185; 1973.* (11 references)

A GC/MS computer system, widely used by the Environmental Protection Agency for the identification of naphthalenes, polychlorinated biphenyls, and numerous pesticides and other organic compounds in complex mixtures, is a multi-purpose, integer resolution quadrupole mass spectrometer system interfaced with a general-purpose computer and GC. Ionizing voltage, emission current, and lens voltage are variable, and the electron multiplier is mounted off-axis from the mass filter to interrupt the path from the mass filter and the ion source to the electron multiplier. The resolution is 1200 at mass 600 and the total range which can be scanned is from 1 to 1000 amμ. Inlets include a solids probe, a batch sample inlet system, and a GC interface. The computer controlled system has the advantages of

speed and the ability to scan repetitively and continuously.

74-0216. Rajzman, A. (Volcani Inst. of Agr. Res., Div. of Fruit and Vegetable Storage, Rehovot, Israel). **A colorimetric method for the determination of 2-phenylphenol residues in citrus fruits.** *Analyst (London) 97: 271-278; 1972.* (12 references)

A colorimetric method for the determination of 2-phenylphenol residues in citrus fruit, based on a specific color reaction given by 2-phenylphenol with sulphuric acid, trace amounts of formaldehyde, and iron(III) is described. 2-Phenylphenol is extracted from the fruit with chloroform, transferred into an alkaline medium, and, after acidification of the latter, reextracted with chloroform. The extract is purified with 86.3 per cent w/w sulphuric acid and the 2-phenylphenol is then determined colorimetrically. The method permits the determination of small amounts of 2-phenylphenol of the order of 0.05, 0.3 and 0.1 ppm in the pulp, peel and whole fruit, respectively. The recovery of 2-phenylphenol varies between 95 and 106 per cent. (Author abstract by permission)

74-0217. Baker, P. B.; Farrow, J. E.; Hoodless, R. A. (Dept. Trade and Ind., Lab. Government Chemist, Cornwall House, London, SE1 9NQ, England). **Carbon tetrachloride as a possible source of interference during fumigant residue analysis.** *Analyst (London) 98(1170): 692-693; 1973.* (1 reference)

Impurities were found in several solvents during analysis for carbon tetrachloride fumigant residues in grain. Gas chromatography with an electron capture detector revealed a contaminant in acetone with a retention time similar to that of carbon tetrachloride. This peak was presumed to originate from carbon tetrachloride contamination of laboratory air, since it was not one of the impurities normally present in acetone. Acetone left in an open beaker in the laboratory rapidly became contaminated (up to 10 ng/ml in 4 hours). When laboratory air was drawn through acetone, using a vacuum pump, carbon tetrachloride contents of 10 to 100 $\mu g/m^3$ were found in the air. Aerosol propellent cans used for spraying thin-layer chromatograms were a possible source of atmospheric carbon tetrachloride; the propellents examined contained carbon tetrachloride at 0.1-0.2 mg/kg. This source of interference should be kept in mind.

74-0218. Toet, L.; Toet, M. J. (Tobacco Res. Board of Rhodesia, P.O. Box 1909, Salisbury, Rhodesia). **Method for one step DDT extraction and cleanup in tobacco for monitoring purposes.** *Beitr. Tabakforsch. 7(2): 93-98; 1973.*

A simplified method for extracting and purifying tobacco samples for determination of organochlorine pesticides by GC analysis has been devised. Tobacco samples were mixed with silica gel and sodium sulfate, transferred to a paper thimble and extracted in a Soxhlet apparatus in petroleum ether for eight hours. When the flask was nearly full, the extract was removed, cooled, diluted to 100 ml, and analyzed directly on the GC. A second extraction with 5% ether in petroleum ether was performed if it was necessary to remove compounds such as endosulfan sulfate before analysis of dieldrin and other more polar pesticides. Recoveries of added γ-BHC, heptachlor, aldrin, DDE, TDE, and DDT ranged from 94 to 100%. The method was just as accurate, more rapid, and more economical than other methods used for comparison.

74-0219. Kvalvag, J. (Chem. Res. Lab., Agr. Univ. Norway, 1432 As-NLH, Norway). **A new colorimetric procedure for the determination of benomyl.** *Bull. Environ. Contam. Toxicol. 10(3): 137-139; 1973.* (4 references)

The colorimetric determination of benomyl and its metabolites has been simplified and a suitable method of analysis, based on previously published extraction, hydrolysis, and clean-up procedures, established. Aqueous residue extracts remaining after evaporation of ethyl acetate were brought to a volume of 5 ml and transferred to an optical cell. Sodium hypochlorite solution was added and the absorbance immediately recorded. Although the color faded rapidly to a brownish yellow, good agreement with Beer's Law was obtained in the concentration range from 2 to 60μg (0.5 ppm benomyl in a 50 g sample). Sensitivity could be increased by reducing the volume, under favorable conditions. Recovery of benomyl from various crops was satisfactory, ranging from 82% to 93%.

74-0220. White, E. R.; Al-Adil, K. M.; Winterlin, W. L.; Kilgore, W. W. (Dept. Environ. Toxicol., Univ. California, Davis, CA 95316). **Extraction efficiency determinations of labeled systemic parathion residues.** *Bull. Environ. Contam. Toxicol. 10(3): 140-144; 1973.* (8 references)

Several methods of extraction, all using acetonitrile as solvent, were tested for efficiency in removing residues from plants grown for six days in medium containing 1,2-^{14}C-ring-labeled parathion. Greater than 90% recoveries were obtained with the Turbo-shear Virtis homogenizer, the Polytron homogenizer, the Waring blender, and soxhlet extraction; sonication yielded only 61% of the total dpm (determined by combustion of the macerate). The Polytron method took only 30 seconds while other methods required up to eight hours (soxhlet). Radioactive metabolites did not appear in any higher concentration in plant extracts than in the original formulation.

74-0221. Farwell, S. O.; Beland, F. A.; Geer, R. D. (Dept. Chem., Montana State Univ., Bozeman, MT

59715). **Voltammetric identification of organochlorine insecticides, polychlorinated biphenyls, polychlorinated naphthalenes and polychlorinated benzenes.** *Bull. Environ. Contam. Toxicol. 10(3): 157-166; 1973.* (8 references)

Reduction voltammograms, obtained using apparatus with three-electrode potentiostatic control circuitry with interruptable linear voltage sweep control, have been used to "fingerprint" more than 100 organochlorines. The reference electrode was an aqueous saturated calomel electrode, a platinum wire was the auxiliary electrode, and a mercury-coated platinum electrode with an area of 42 mm^2 was the working electrode. The solvent used was dimethyl sulfoxide with 0.1*M* tetraethylammonium bromide as supporting electrolyte. Polychlorinated biphenyls, polychlorinated naphthalenes, polychlorinated benzenes, and organochlorine insecticides have been identified using this technique, and mixtures of these compounds in environmental samples could be separated and identified using a combination of GC and voltammetric analysis.

74-0222. Sztark, W.; Kwapniewski, Z. (Inst. Inorgan. Chem. Technol., Polytechnica, Krakow, Poland). **Oznacanie manebu obok soli miedzi. [Determination of maneb in the presence of copper.]** *Chem. Anal. (Warsaw) 18(1): 105-107; 1973.* (8 references) (Polish)

Samples containing mixtures of the fungicides copper oxychloride and maneb were digested in a Kjeldahl flask, then subjected to electrolysis using a platinum electrode. The copper precipitated after electrolysis was weighed, and the supernatant was taken for maneb analysis. After treatment with sulfamic acid, ascorbic acid, and potassium cyanide and adjustment of volume and pH, the solution was titrated with 0.01 *M* EDTA, using Eriochrome T as the indicator.

74-0223. Sztark, W.; Kwapniewski, Z. (Inst. Inorgan. Chem. Technol., Polytechnica, Krakow, Poland). **Oznaczanie manebu, siarki i tiuramu w mieszanej formie uzytkowej srodkow grzybobojczych. [Determination of maneb, sulfur, and thiram in a mixed fungicide formulation.]** *Chem. Anal. (Warsaw) 18(1): 109-115; 1973.* (24 references) (Polish)

A method was developed for separation and determination of biologically active components in a mixed formulation of fungicides containing maneb, sulfur, and thiram. The separation is based on differences in solubility of these components in carbon tetrachloride and acetone. Maneb was determined by breakdown to carbon disulfide in an acidic medium. The carbon disulfide was absorbed in a methanolic potassium hydroxide solution, converted to potassium methylxanthate, and titrated with iodine. Thiram was determined by acidimetric titration of the amine formed by hydrolytic decomposition of thiocarbamyl in the acidic medium. Sulfur was determined gravimetrically by filtration from an acetone solution through a filter crucible. This procedure may be applied to formulations containing any two or all three of the components mentioned. (From author abstract)

74-0224. Sundaram, K. M. S. (Chem. Contr. Res. Inst., Ottawa, Ontario, Canada). **Role and operation of the pesticide analytical service at the Chemical Control Research Institute.** *Chem. Contr. Res. Inst. Inform. Rep. CC-X-38, 1973, 37 p.* (10 references)

The Canadian Chemical Control Research Institute was established in 1972 to investigate the distribution of pesticide residues in the forest environment and assist in evaluating their impact on the ecosystem. The general procedure currently used in the total residue analysis from a forest spray operation begins with proper sampling, mixing and quartering, and storage of samples below 0° for transport to the analytical laboratories. Subsamples were comminuted by using hand clippers or "Hobart" choppers, and residues were extracted by blending or macerating with a suitable solvent. Fats, waxes, and other organic co-extractives were removed by partitioning between two liquid phases, and column adsorption was used to remove trace contaminants. After concentration pesticide residues were determined by electron capture and flame photometric GC and confirmed by TLC and spectroscopic techniques. Specific procedures and operation of the Institute have been described. Investigations revealed that DDT was concentrated, but not to hazardous levels, in small mammals, and methoxychlor was ecologically safe because of its rapid degradation. Fenitrothion was also readily degraded in the forest environment.

74-0225. Svojanovsky, V.; Nebola, R. (Vojensk. Akad. Antonina Zapotockeho a Lachema, Brno, Czechoslovakia). **Kombinovany plamenoionisacni-fotometricky detektor pro specificke stanoveni organofosforovych latek. [Combined flame ionization-photometric detector for specific determination of organophosphates.]** *Chem. Listy 67(3): 295-301; 1973.* (11 references) (Czech)

A combined flame ionization-photometric detector has been constructed for the gas chromatographic determination of trace amounts of toxic organophosphorus compounds. The flame photometric system of the detector has a quartz lens which magnifies the image of the flame ten-fold and directs it onto the sensitive layer of the 1P21 photomultiplier. An interference filter, inserted immediately in front of the photomultiplier, ensures the selective properties of the photometric system. The noise level of the flame photometric system under these conditions is 8.2×10^{-11} A, and its signal is 200 times higher than that of the flame ionization system alone. Using the apparatus described, the following detection limits (minimum detectable quantities) were obtained: DMP (diisopropyl methyl phosphonate) 3.5×10^{-10} g/sec, TEPP 7.7×10^{-10} g/sec;

dichlorvos 5.7 X 10^{-9} g/sec; paraoxon 1.2 X10^{-8} g/sec; disulfoton 1.9 X 10^{-8} g/sec; and malathion 2.0 X 10^{-8} g/sec.

74-0226. Stijve, T. (Author address not given). **Tekortkomingen van de residu-analyse: toegepast op bestrijdingsmiddelen en enkele andere milieu verontreinigende stoffen. [Shortcomings of residue analysis—applied to pesticides and other environmental pollutants.]** *Chem. Tech. (Amsterdam) 28(3): 47-50; 1973.* (25 references) (Dutch)

Despite the enormous advances in residue analysis within the past decade, due primarily to the development of specific gas chromatographic detectors, more work is needed, especially on reliable screening methods for detecting many pesticides simultaneously. Several examples illustrate analytical pitfalls. The presence of hexachlorobenzene in adipose tissue and in human milk was first reported in 1970 although this fungicide has been used since 1945. This was probably due to the inability of most gas chromatographic columns to separate HCB from BHC isomers. Earlier findings of this compound may not have been reported by analysts, as the quantities present are greater than accounted for by seed dressing. This was eventually explained by the fact that PCNB formulations contain 2-3% HCB; the PCNB is rapidly broken down whereas HCB persists. Criteria for residue identification are problematic at present: the reliable techniques employed in standard organic macroanalysis, such as elemental analysis, functional-group reactions, and determinations of physical constants, are generally not applicable to residue analysis. The use of chemical identity reactions, such as derivatization, has improved confirmatory reliability in many cases. Examples of problems in the analysis of specific substances are presented.

74-0227. Hadorn, H.; Zuercher, K. (Zentrallab. der Coop Schweiz, Basel, Switzerland). **Planung und Durchfuehrung von Ringversuchen fuer die Bestimmung von Insektizid-Rueckstaenden. [Planning and performance of collaborative tests for the determination of insecticide residues.]** *Deut. Lebensm.-Rundsch. 69(6): 213-218; 1973.* (3 references) (German)

Laboratories employing a single analytical method must make minor modifications in technique which may account for the observed variation in results. Collaborative experiments aimed at determining the range of variation were performed, using a naturally contaminated cheese and a rapeseed oil spiked with known amounts of insecticides. The oil used contained only small amounts of insecticides before spiking. The procedure used for cheese involved extraction of the fat containing the insecticides from the cheese (mixed with sodium oxalate and ether) using an ether-petroleum ether mixture. The seed oil and the fat obtained after evaporation of the solvent were cleaned up by passage over a celite-sulfuric acid or a celite-magnesium oxide column and analyzed by gas chromatography in three of the laboratories; the other seven laboratories used the AOAC method (acetonitrile partitioning) for cleanup. Assuming routine command of the method, insecticide recoveries of at least 85% were obtained. Eight out of ten laboratories achieved acceptable results if an error range of -30% to +15% was allowed. Results were highly unsatisfactory in the case of HCB. The laboratories using column chromatographic cleanup were unable to detect β-BHC.

74-0228. Tadzhiyev, M. A.; Ikramov, L. T. (Tashkent Inst. Pharmaceutics, Tashkent, USSR). **Reaktsii obnaruzheniya bazudina. [Reactions suitable for the identification of diazinon.]** *Farmatsiya 22: 79-81; 1973.* (Russian)

Chemical reactions suitable for the microcrystallographic identification of the organophosphorus pesticide diazinon in formulations and in cadaver materials are described. After extraction of samples with diethyl ether and transfer of the diazinon residue into ethanol, diazinon residue samples combined with a 1%-solution of palladium chloride formed dark orange prismatic crystals in 30-40 min. The lower limit of detection for this reaction is 6μ. Formation of characteristic crystals was noted 7-8 hr after treatment of the sample with phosphotungstic acid plus nitric acid. The lower limit of detection in this case was 8 μg. Spindle-shaped microcrystals were observed 5-6 hr after the addition of phosphotungstic acid plus hydrochloric acid to the sample; the lower limit of detection here was 3 μg. Elongated brown microcrystals were formed after reaction of diazinon with iodine chloride. The sensitivity of this reaction was 65 μg.

74-0229. Lytvynenko, A. V.; Bernshtein, V. M.; Davydenko, A. S. (Pyatigorsk Pharmaceutical Inst., Pyatigorsk, USSR). **Kol'orovi reaktsiyi na armin, nibufin ta fosfakol. [Color reaction for armine, nibufin and phosphacol.]** *Farm. Zh. 27: 71; 1972.* (3 references) (Ukrainian)

A method for detecting the anticholinesterase compounds armine, nibufin (*p*-nitrophenyl ester of di-*n*-butylphosphinic acid), and phosphacol (paraoxon) is described. The addition of zinc dust and a 10% aqueous solution of calcium chloride to a 0.02% aqueous solution of the compounds converted the nitro group on the phenyl ring to a nitroso group. Subsequent addition of sodium pentacyanoaminoferroate produced color by which the individual compounds could be identified: blue (λmax at 680 nm) for armine, turquoise (λmax at 700 nm) for nibufin, and red-violet for paraoxon. This method can detect a minimum of 2 μg/ml of armine and nibufin and 10 μg/ml of paraoxon. The color reaction was unsuitable for other anticholinesterase compounds such as eserine salicylate, galanthamine, proserine, oxacil, and pyrophos.

74-0230. Gesser, H.-D.; Sparling, A. B.; Chow, A.; Turner, C. W. (Dept. Chem., Univ. Manitoba, Winnipeg, Manitoba, Canada). **The monitoring of organic matter with polyurethane foam.** *J. Amer. Water Works Ass. 65(3): 220-221; 1973.* (8 references)

The use of polyurethane foam plugs has been a good alternative to use of carbon in extracting trace polychlorinated biphenyls and organochlorine pesticides from water. A standard carbon adsorption metering apparatus was used, but carbon was replaced by polyurethane foam. Water at the treatment plant in Morris, Manitoba, was sampled before and after the carbon-alum-chlorine treatment. Organic material was extracted from the foam plugs with hexane. The hexane extract was concentrated to 5 ml and analyzed by electron capture GC. Organic contaminants in raw river water were not significantly reduced by the treatment process, but levels were below the 100 ppb limit set for drinking water.

74-0231. Hanks, A. R.; Engdahl, B. S.; Colvin, B. M. (Dept. of Agr. Anal. Serv., Texas A&M Univ., College Station, TX 77843). **Gas-liquid chromatographic determination of Erbon in herbicide formulations.** *J. Ass. Offic. Anal. Chem. 56(5): 1087-1090; 1973.* (4 references)

A simple and rapid gas-liquid chromatographic method, using flame ionization detection and a column packed with 5% silicone UCW 98 on Chromosorb W (HP), is described. Herbicide formulations containing Erbon are dissolved in chloroform, and Kepone (chlordecone) is added as an internal standard. The sample solutions are injected directly into a gas chromatograph, and peak height ratios are used for quantitation. Using commercial herbicide formulations as test material, this procedure compares well with the more commonly employed titrimetric and total chloride procedures. As presented, this gas chromatographic technique has not been extended to include an estimation of the related compounds in technical Erbon. However, quantitation of these related compounds by this procedure is not precluded. This procedure does provide a method for more directly determining the compound of primary interest in Erbon formulations. (Author abstract by permission)

74-0232. McDermott, W. H. (Res. and Develop. Dept., Union Carbide Corp., P.O. Box 8361, South Charleston, WV 25303). **Infrared spectrophotometric analysis of aldicarb formulations.** *J. Ass. Offic. Anal. Chem. 56(5): 1091-1092; 1973.*

The infrared method described for the assay of aldicarb formulations measures the carbamate carbonyl absorption band at 5.75 μm after extraction with methylene chloride in a Soxhlet extractor. An average recovery of 100.2% was obtained on laboratory-prepared simulated formulations. The standard deviation on repeatability studies on two formulations was ±0.2% at the 10% level. The coefficient of variation was ±2%. (Author abstract by permission)

74-0233. Hanks, A. R.; Engdahl, B. S.; Colvin, B. M. (Dept. of Agr. Anal. Serv., Texas A&M Univ., College Station, TX 77843). **Gas-liquid chromatographic determination of chlorpyrifos in Dursban insecticide formulations.** *J. Ass. Offic. Anal. Chem. 56(5): 1093-1095; 1973.* (15 references)

A simple and rapid gas-liquid chromatographic method, using flame ionization detection and a column packed with OV-17/QF-1 on Gas-Chrom Q, is described. Chlorpyrifos is extracted from the formulation with chloroform, and dieldrin is added as an internal standard. The sample extract is injected into a gas chromatograph, and peak height ratios are used for quantitative measurement. Application of the method to commercial samples gives good precision. The gas chromatographic procedure is far superior to the total chloride method for the determination of chlorpyrifos and yields values in close agreement to those obtained by infrared and colorimetric methods. (Author abstract by permission)

74-0234. Ihnat, M.; Westerby, R. J.; Hoffman, I.* (Environmental Secretariat, Div. of Biol. Sci., Nat. Res. Council, Ottawa, Ontario, Canada K1A OR6). **Determination of maleic hydrazide residues in tobacco and vegetables.** *J. Ass. Offic. Anal. Chem. 56(5): 1164-1172; 1973.* (19 references)

The distillation-spectrophotometric method of Hoffman for determining maleic hydrazide has been modified to include a double distillation and was applied to the determination of 1-30 ppm maleic hydrazide residues in tobacco and vegetables. Recoveries of 1-23 μg added maleic hydrazide were independent of weight of maleic hydrazide, but did depend on sample and sample weight. The following recoveries were obtained from 0.5 g sample: pipe tobacco, 84%; commercially dehydrated potato, 76%; flue-cured tobacco, 73%; dried carrot, 71%. In the absence of sample the recovery was 82%. When appropriate standard curves were used, maleic hydrazide levels determined in tobacco samples were essentially independent of sample weight in the range 0.1-3 g. The mean relative standard deviation for a variety of field-treated and fortified tobacco samples containing 1-28 ppm maleic hydrazide was 3%. The precision and sensitivity of this procedure seem to be substantial improvements over offical method 29.111-29.117. It is recommended that the present method be subjected to a collaborative study. (Author abstract by permission)

74-0235. Stretz, P. E.; Stahr, H. M. (Vet. Diagnostic Lab., Coll. of Vet. Med., Iowa State Univ., Ames, IA 50010). **Determination of chlorinated pesticides in whole blood.** *J. Ass. Offic. Anal. Chem. 56(5): 1173-1177; 1973.* (6 references)

Eight whole blood samples spiked with lindane, dieldrin, and *p,p'*-DDT at levels of 2.5, 12.6, 126, and 630 ppb each were sent to 11 collaborators for analysis. The method evaluated uses sulfuric acid to liberate the pesticides from the blood matrix. The pesticides are then extracted with 10% acetone in hexane. Pesticides were identified and quantitatively analyzed by gas-liquid chromatography using an electron capture detector. Mean values at all levels are in good agreement with the spiking levels. However, statistical analysis of the data reveals a large systematic error. Further evaluation of the sulfuric acid method by comparison with other methods is recommended. (Author abstract by permission)

74-0236. Larose, R. H.; Chau, A. S. Y. (Inland Waters Branch, Water Quality Div., Dept. of the Environ., P. O. Box 5050, Burlington, Ontario, Canada L7R 4A6). **Herbicide analysis: relationship between molecular structure and retention index.** *J. Ass. Offic. Anal. Chem. 56(5): 1183-1187; 1973.* (8 references)

Retention indices are used to predict the retention time of the series of chlorophenoxy acids. The total retention index is divided into three additive components: the alcohol contribution, the acid contribution, and the interaction contribution. This paper discusses five acids which are commonly used as herbicides, eight alcohols, and three GLC columns. (Author abstract by permission)

74-0237. Zelenski, S. G.; Tashiro, J.; Worthen, L. R.*; Olney, C. E. (Dept. of Pharmacognosy, Coll. of Pharm., Univ. of Rhode Island, Kingston, RI 02881). **A gas chromatographic method of quantitating DDT in the presence of interfering polychlorinated biphenyls.** *J. Chromatogr. 84(1): 67-73; 1973.* (8 references)

The *p*-value, defined as the fraction of total solute that distributes itself in the nonpolar phase of an equivolume solvent pair, has been used for quantitating DDT in DDT-PCB mixtures. An equation for determining the quantity of a component present was derived, based on the initial assumption that gas chromatographic peak heights in the mixture would be additive. Stock solutions of *p,p'*-DDT and HCB-IX, a PCB component eluting from the gas chromatograph with DDT, were prepared in light petroleum, then analyzed by GLC. An equal volume of acetonitrile was then added, the mixture shaken, and an aliquot of the nonpolar phase injected into the gas chromatograph. When the derived equation was used to determine the amount of *p,p'*-DDT present, large errors were obtained, presumably because the peak heights were not additive. Therefore, an empirical curve was generated using several mixtures of known composition. "Unknowns" analyzed using this curve gave results accurate to within 11% of the actual values. Mixtures containing more than about 90% of *p,p'*-DDT could not be analyzed because the curve would give duplicate values. This method offers advantages of speed and simplicity over other methods using additional separation of chemical reaction steps.

74-0238. Kumar, R.; Burkhardt, C. C. (Dept. Entomol., Univ. Wyoming, Laramie, WY 82070). **Bioassay sensitivity of test organisms to insecticide residues.** *J. Kansas Entomol. Soc. 46(2): 276-280; 1973.* (12 references)

A comparison of the sensitivities of different insects to Cytrolane (mephosfolan) and Cyolane (phosfolan) indicated that mosquito larvae, followed by pomace flies and house flies, were the most suitable for use in a bioassay. Residues obtained after extraction of samples of field treated alfalfa were dissolved in acetone and water, filtered, and deposited uniformly on the walls of bioassay jars. Insects were exposed for periods of 12 or 24 hr. Direct maceration and exposure of test insects to a slurry of plant material failed to provide reliable data.

74-0239. Tatsukawa, R. (Dept. of Agr., Ehime Univ., Matsuyama, Japan). **[PCB, BHC, and other organochlorine compounds.]** *Nippon Rinsho (Jap. J. Clin. Med.) 31(6): 1966-1970; 1973.* (Japanese)

Organochlorines can be measured with high accuracy by ECD gas chromatography which is particularly sensitive to chlorine containing compounds. If the sensitivity of ECD to hexane is set at a value of 0.9, that to the same weight of γ-BHC (lindane) is 11,000,000; to DDT, 2,000,000; and to carbon tetrachloride, 400,000,000. The operating procedures of the ECD gas chromatograph, analytical method, reliability of measurements, effects of coexisting impurities and degraded materials, sampling problems, and residue concentration and toxicity are discussed.

74-0240. Suzuki, T.; Kumano, M. (Nihon Noyaku Co., Ltd., Tokyo, Japan). **[Method for determining chlorophenamidine residues in unpolished rice.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 68-69; 1973.* (1 reference) (Japanese)

A sensitive method for determining chlorophenamidine (chlordimeform) residues in unpolished rice was developed, based on the high sensitivity of GLC-ECD for 4-chloro-*o*-toluidine iodide, a hydrolysis product of chlorophenamidine. Crushed unpolished rice is extracted with a methanol-dichloromethane-dilute hydrochloric acid mixture, and the condensed extract is cleaned up by partitioning between *n*-hexane-water and *n*-hexane-hydrochloric acid-water. The residue remaining in the water phase is hydrolyzed to 4-chloro-*o*-toluidine with 0.5 *N* NaOH at an elevated temperature; the product is then dissolved in hydrochloric acid. The hydrolyzate is iodinated by adding a saturated solution of iodine in acetic acid-iodine water. The reaction product, 4-chloro-6-iodo-*o*-toluidine, is extracted with *n*-hexane

and determined using a calibration curve. The limit of detection is 0.001 ppm, with recovery of more than 80% when 0.1 ppm of chlorophenamidine is added to untreated unpolished rice. Methods using for confirming the identity of the iodination product and conditions for the analytical procedures are reported.

74-0241. Asaka, S.; Izawa, T.; Seguchi, N.; Miyauchi, K. (Ageo Res. Inst., Nihon Kayaku Co., Ltd., Ageo, Japan). **[Residue analysis of chlorobenzilate in fruits and vegetables.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 70; 1973.* (Japanese)

A method was developed for determining chlorobenzilate as a derivative of heptafluorobutyric acid, using GLC-ECD. The method was applied to determination of residues in fruits and vegetables. Chlorobenzilate is extracted with acetonitrile, transferred to *n*-hexane, cleaned up on a Florisil column, and treated with heptafluorobutyric acid in the presence of a catalyst; the derivative formed is washed and determined. The GLC-ECD conditions are: glass column 4 mm i.d., 1000 mm long, packed with 5% SE-30; detector temperature 210°C, ECD with tritium-labeled foil. Recoveries of 88.6% and 91.1% were obtained from radish and strawberry fortified with 0.05 ppm of chlorobenzilate, 84.1% from Satsuma orange fortified with 0.1 ppm, and 93.6% from summer orange pulp fortified with 0.05 ppm. The same analytical procedure but without the reaction with heptafluorobutyric acid showed a sensitivity only one sixteenth of that obtained when the reaction mentioned was included in the procedure.

74-0242. Numata, T.; Shinozaki, C.; Takano, J. (Biochem. Res. Inst., Nissan Chem. Ind. Co., Ltd., Shiraoka, Japan). **[Residue analysis of an acaricide, Danicut: a microanalytical method for nitrogen-containing pesticides using FTD with rubidium sulfate.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 71-72; 1973.* (Japanese)

Danicut (1,5-di-(2,4-dimethylphenyl)-3-methyl-1,3,5-triazapenta-1,4-diene) decomposes readily under acidic conditions, and is stable only at a pH of more than 8. However, this pesticide is often applied to plants with acidic fruits so that cleanup and column chromatographic extraction had to be carried out under alkaline conditions, using a specific solvent for each specimen. For example, *n*-hexane is used for citrus pulp and apple, and acetonitrile is used for citrus peel and soil. The recoveries from fortified citrus pulp, citrus peel, and apple were 97, 87, and 97%, respectiviely. Actual results of determination of the residue in field-treated fruits showed that Danicut residues were very short lived in apple and citrus fruits. For example, after 3 applications of 30 liters of a 400-fold diluted emulsion of 20% EC per apple tree, the residue in apple fruit was 0.10, 0.04, and 0.03 ppm, respectively, on the 7th, 15th, and 30th days after application. According to the results of a model experiment in soil, the half life of Danicut was only 3 hr. The fact that Danicut does not contain any element which is selectively detectable by ECD necessitated the use of rubidium FTD. The results suggest that the method described is suitable for use with other pesticides which have no hetero atom specifically detectable by ECD.

74-0243. Takahashi, M.; Numata, T.; Oya, T.; Takano, J. (Biochem. Res. Inst., Nissan Chem. Ind. Co., Ltd., Shiraoka, Japan). **[Pesticide residue analysis in rice straw.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 73-74; 1973.* (Japanese)

Although residue data on rice straw must be supplied in applications for registration of pesticides used in protection of rice crops, reports on determination of such residues on rice straw are rare. Results of a study on the methods of determining eight pesticide residues on rice straw are reported. The determination was based on GLC, with FPD in the case of organophosphorus pesticides and with ECD in other cases. Although many kinds of pigments in rice straw are extractable with solvents, making the cleanup procedure difficult, column chromatographic cleanup for phorate , EPN, and EPBP (2,4-dichlorophenyl ethyl phenylphosphorothioate) was adequate for individual detection by FPD with 94-100% recovery. While swep and captan also gave good recovery with column chromatographic cleanup, oxidiazon, its metabolite, and 2,4-D required additional steps. Oxadiazon was 96% recovered after combined TLC-column chromatographic cleanup. The presence of a carboxyl group in the molecule necessitated esterification of the oxidiazon metabolite and 2,4-D. Esterification is hindered by the rice straw pigments; it was necessary to decolorize and purify the sample before removing the reaction products. These methods would be effective in residue analysis using a detector of lower sensitivity.

74-0244. Asaka, S.; Seguchi, K. (Ageo Research Inst., Nihon Kayaku Co., Ltd., Ageo, Japan). **[Microanalysis of methyl bromide residues.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 77; 1973.* (Japanese)

Although methyl bromide residues in crops have been determined by GLC, it is difficult to concentrate the residue because of its high volatility. An attempt was made to obtain derivatives offering specificity and selectivity in GLC, and it was found that *O,O*-diethyl *S*-methyl dithiophosphate (DEMDP) and 2,5-dichlorophenyl methylsulfide (DCPMS) serve for the purpose. The derivatives were synthesized by bubbling methyl bromide, stripped from the specimens by codistillation with a nitrogen stream, into a methanolic solution of either ammonium *O,O*-diethyl dithiophosphate or 2,5-dichlorobenzenethiol, with yield of 99-109%. The excess regent, which interferes with the determination, was removed by liquid-liquid extraction. As little as 0.5 ng of DEMDP and DCPMS could be detected by FID

and ECD. With FTD, the high selectivity of the detector made the determination easier, and the reaction mixture could be condensed to increase the detection sensitivity. The recovery of methyl bromide from wheat grain and poultry feed fortified at 0.5 ppm was 80.4 and 81.1% after conversion into DEMDP. Recovery from wheat grain and poultry feed fortified at 10 ppm was 82.0 and 81.0% after conversion to DCPMS, respectively. The sensitivity was 1 ppb, adequate for residue analysis.

74-0245. Yatabe, H.; Kiyohara, M.; Watanabe, Y. (Res. Dev. Inst., Hokko Chem. Co., Ltd., Atsugi, Japan). **[Residue analysis of copper 8-quinolinolate.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 78-79; 1973.* (Japanese)

Although copper 8-quinolinolate in formulations is determined by extracting the compound and colorimetry of its inherent yellow color, it was considered preferable to derivatize the compound for residue analysis. An attempt was made to detect the compound in apples using the color which was developed by reaction of copper 8-quinolinolate with *p*-nitrobenzenediazonium fluoroborate. Copper 8-quinolinolate was extracted from apples with methanol which had been acidified with phosphoric acid. After all the solvent was distilled off, the residue was dissolved in water at a pH of less than 2. The aqueous solution was first extracted with *n*-hexane to remove interfering substances, then after adjustment of the pH of the aqueous layer to 5-5.5, copper 8-quinolinolate was extracted from the aqueous layer with chloroform. After evaporation of the solvent and uptake of the residue into methanol, the methanolic solution was made weakly alkaline. Potassium cyanide was added to bind the copper; *p*-nitrobenzenediazonium fluoroborate was then added. The extinction of the reddish-purple solution was measured at 555 nm. The limit of detection was 1 μg, and the sensitivity was 0.02 ppm. The recovery from apple fortified at 0.2 ppm was 84.8%.

74-0246. Abe, H.; Amma, K.; Ishikawa, K. (Inst. Biol. Sci., Kumiai Chem. Co. Ltd., Kikukawa, Japan). **[Studies on residue analysis of neoasozin (ferric methanearsonate), Part 2. Method of isolating methanearsonate.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 80-81; 1973.* (Japanese)

In spite of efforts to establish a method for analysis of methanearsonic acid in a variety of samples, no effective method has been established because of the natural background levels of arsenic. The authors attempted to determine methanearsonic acid for analyzing ferric methanearsonate (MAF). The standard arsenic compounds used in this study were ferric methanearsonate, disodium methanearsonate, arsenic acid, arsenious acid, phenylarsinic oxide, phenylarsonic acid, arsanilic acid, and cacodylic acid. The silver diethyldithiocarbamate method was used. Organoarsenic and inorganoarsenic compounds were separated by complexing arsenic with molybdic acid, extracting arsenious compounds with SH-reagents such as thionalide and sodium xanthogenate, and separating the compounds by alumina column chromatography. Compounds containing phenyl group(s) such as phenylarsinic oxide, phenylarsonic acid, and arsanilic acid could be removed during decolorization with activated charcoal. The arsenic compounds were quantitatively recovered by first extracting a 6*N*-HCL solution containing 1.2*M* of KI with benzene, then transferring into the water layer, leaving behind almost all the impurities. The final method of confirmation of the arsenic compounds using TLC on cellulose showed a satisfactory separation of methanearsonic acid.

74-0247. Hagi, I.; Oyama, J.; Otari, O. (Central Inst., Ishihara Sangyo Co., Ltd., Kusatsu, Japan). **[Analysis of residues of MCPA derivatives in crops and soil. A method for analysis of 2-chloro-*o*-tolyloxyacetanilide, allyl 2-chloro-*o*-tolylacetate, ethyl 2-chlorotolylacetate, and sodium 2-chloro-*o*-tolylacetate residues.]** *Noyaku Kagaku (J. Pestic. Sci.) 1(2): 82-83; 1973.* (Japanese)

A method for determining residues of the four title herbicides in unpolished rice and in rice straw was studied. After extraction of the residue with an organic solvent such as acetone, methanol, or benzene, the anilide and esters were hydrolyzed to sodium 2-chloro-*o*-tolylacetate, and the salt was converted to the chloroethyl ester using an improved method. Before esterification but after hydrolysis the free acid was washed with *n*-hexane in aqueous hydrochloric acid to remove impurities. The chloroethyl ester was purified on a Florisil column. GLC with ECD was used. The results of actual residue analysis of unpolished rice and rice straw showed that the residue present was below the detection limit of 0.005 ppm. Model experiments carried out on soil fortified with the four herbicides in flooded paddy field conditions showed that the half lives of the four herbicides were less than 10 days.

74-0248. Visweswariah, K.; Jayaram, M. (Cent. Food Tech. Res. Inst., Mysore, India). **Rapid semiquantitative estimation of benzene hexachloride by micro-t.l.c.** *Pestic. Sci. 4(3): 283-287; 1973.* (10 references)

The relationship between the spot concentration and the resolution of different components in commercial hexachlorocyclohexane (BHC) with micro- and macro-thin layer chromatography has been studied. Of the different spot concentrations investigated, only 0.025 μg on micro-t.l.c. and 1.0 μg on macro-t.l.c. gave two clear spots which can be made use of for the rapid semiquantitative estimation of benzene hexachloride in insecticide formulations. The application of this technique has been further investigated on different commercial benzene hexachloride dust formulations, and the error ranged between 2 and 5%. (Author abstract by permission)

74-0249. Whiteoak, R. J.; Crofts, M.; Harris, R. J. (Fisons Ltd., Agrochem. Div., Chesterford Park Res. Sta., Nr. Saffron Walden, Essex CB10 1XL, England). **Gas chromatographic method for the residue analysis of soil exposed to fenazaflor.** *Pestic. Sci. 4(3): 319-325; 1973.* (4 references)

Hydrolysis of fenazaflor to 5,6-dichloro-2-trifluoromethyl-benzimidazole in soil is generally complete within 24 hr so that this derivative is determined in residue analysis. Optimal conditions for determination were sought. In a test of alternative soil extraction systems, 2-propanol-dichloromethane was at least as efficient as acidified aqueous methanol in extracting residues from weathered field samples. However, the moisture level of the soil greatly affected the extraction results with the first-mentioned system, and attempts to compensate for this factor were troublesome. Shaking was as efficient as maceration for extraction. Alkaline digestion of soil samples improved the recovery of residues by only about 1%, and was considered unnecessary. An aliquot of the extract was concentrated to remove most of the methanol and cleaned up by shaking with *N*-sodium hydroxide and ether. The combined alkali extract was acidified to pH 1, and the residue was extracted into hexane-ether for estimation by GLC as previously described (see abstract no. 72-2032). Several types of soil have proved satisfactory by this method; recovery from methanol extracts averaged 95%.

74-0250. Heuser, S. G. B. (Pest Infest. Control Lab., Min. Agr., Fish. Food, Slough, Bucks, England). **Determination of residues arising from fumigation practice.** *Pestic. Sci. 4(3): 409-416; 1973.* (10 references)

Fumigant residues have long been neglected in residue analysis, possibly because their volatility is presumed to ensure their dissipation, and possibly because this same volatility complicates analysis. Special precautions must be taken in sample handling. The three principal extraction methods have been steam distillation combined with scrubbing and concentration in a nonaqueous solvent; acid-reflux distillation; and cold solvent extraction. A single-component solvent is unlikely to meet all requirements for multiresidue analyses. Addition of water to solvent systems greatly improved recovery even of water-insoluble compounds. A multi-detection scheme was developed, using extraction with two solvent systems, drying, and gas chromatography with electron capture, flame ionization, and β-ionization detectors. Formation of a more volatile derivative is useful in the case of some nonvolatile fumigant residues. This technique has also been used in recent studies on reaction of amino acids in foods with fumigants which have alkylating properties. Promising new developments for fumigant residue analysis include high-pressure liquid chromatography and a microwave-powered helium plasma spectrometric detector.

74-0251. Ruzicka, J. H. A. (Lab. Govt. Chem., Cornwall House, Stamford St., London SE1 9NQ, England). **Organophosphorus and carbamate detection system.** *Pestic. Sci. 4(3): 417-423; 1973.* (41 references)

Recent progress in the separation and identification of organophosphorus and carbamate pesticides is reviewed. Thin-layer chromatography is often used for organophosphate detection, with a variety of visualization reagents. TLC of carbamates was improved by using channel-layer chromatography. New chromatoplate layer materials include polyamide and cellulose layers; the latter permits the use of in situ fluorimetry. Enzyme inhibition detection was also recently introducd, and is sometimes combined with other visualization techniques. The quantitative analysis of organophosphorus pesticide residues was greatly facilitated by development of the alkali flame and flame photometric detectors. Thermal breakdown of certain carbamates interferes with their GLC analysis; this problem was first combated by preparation of derivatives suitable for electron capture detection. The present trend is toward use of thermionic detectors directly after extraction and cleanup; thermionic detectors are highly sensitive to nitrogen. Other nitrogen-selective detectors include microcoulometric and conductivity detectors. Combined gas chromatography and mass spectrometry is used increasingly. Polarography and automated techniques are under investigation.

74-0252. Machin, A. F. (Cent. Vet. Lab., Min. Agr., Fish. Food, New Haw, Weybridge, Surrey, England). **The isolation and possible significance of some toxic mammalian metabolites of diazinon.** *Pestic. Sci. 4(3): 425-430; 1973.* (13 references)

Methods of determining pesticide metabolites in mammalian tissues are reviewed with particular reference to diazinon. In the study of diazinon metabolites gas chromatography has been used preparatively in isolating fractions for mass spectrometric identification. Thin-layer chromatography is used for recognizing toxic metabolites by esterase inhibition and for isolating them; the adsorbent is silica gel, and acetone-hexane is the developing solvent. TLC has been used extensively for isolating the two hydroxy derivatives of diazinon from urine. Metabolites can be separated by TLC in mg quantities; however, TLC will probably be replaced by high-pressure liquid chromatography in most preparative applications. Up to the present time, three metabolites of diazinon have been recognized after oral administration to sheep: two hydroxy metabolites and a dehydro metabolite. These probably account for less than 1% of the dose administered, but their toxicologic significance may be disproportionately high.

74-0253. Karawya, M. S.; Abdel Kader, E. M*.; Khalifa, T. I. (Chem. Ind. Development (CID) Lab., Giza, Egypt).

Estimation of scilladienolides of *Urginea maritima* as well as in galenicals and formulations. *Planta Med. 23(3): 213-220; 1973.* (13 references)

Scilladienolides in fresh local squill bulbs (U.A.R.) as well as in its galenicals and pharmaceutical preparations were successfully separated by TLC. Bulbs contained fourteen glycosidal spots; the drugs Scillaren, Scillaren A, Proscillaridin A, and Scilliglaucoside contained only six. Selective UV absorbance provided a simple and precise method for estimation of the squill glycosides, but extreme care had to be taken due to the high sensitivity. Colorimetric methods based on the Liebermann-Burchard reaction or hydroxamic acid reaction also yielded satisfactory results. These procedures are recommended as a necessary addition to the normal assay for ethanol 60% extractive material as a criterion for the purity of crude squill and for total solids as a criterion for the control of squill extracts.

74-0254. De Prins, H. C. (Lab. Chemie, I.S.A.R, Rwanda). **Colorimetric estimation of pyrethrins in pyrethrum flowers.** *Pyrethrum Post 12(1): 33,22; 1973.* (5 references)

A rapid method for the assay of pyrethrin contents of dry flowers has been developed, permitting the selection of clones of high content for the lengthier AOAC analysis. Finely ground pyrethrum powder was extracted with absolute ethyl alcohol, and mercuric oxide and concentrated sulfuric acid were added as color reagent. After a period of 4-8 min for development, the transmission was read at 550 nm. The spectrophotometric method gave levels approximately 97% of those indicated by the AOAC method.

74-0255. Vlasakova, V.; Benes, J. (Isotope Lab. Inst. Biol. Res., Czechoslovak Acad. Sci., Prague, Czechoslovakia). **GLC analysis of some highly active plant retardants from the group of *N,N*-substituted succinic acid hydrazides labeled with ^{14}C.** *Radiochem. Radioanal. Lett. 14(1): 43-55; 1973.* (7 references)

A GLC method of analysis was developed for seven plant growth retardants, esters of succinic acid *N,N*-dimethylhydrazide (aminozide), which could be extended for determining labeled compounds by introduction of a stream-splitter and fraction collector. Optimum results were obtained when a system of 10% diethylene glycol succinate on a silanized carrier of Gas Chrom Q was used at a temperature of 200°. A flame ionization detector was employed for the determinations. When radioactive compounds were analyzed, glass beads coated with a 2% layer of silicone polymer SE-54 absorbed the separated components in the fraction collector. More than 95% of the radioactivity introduced was recovered during the analysis of octyl and decyl ester labeled with ^{14}C.

See also **74-0017** **74-0033** **74-0043** **74-0067**

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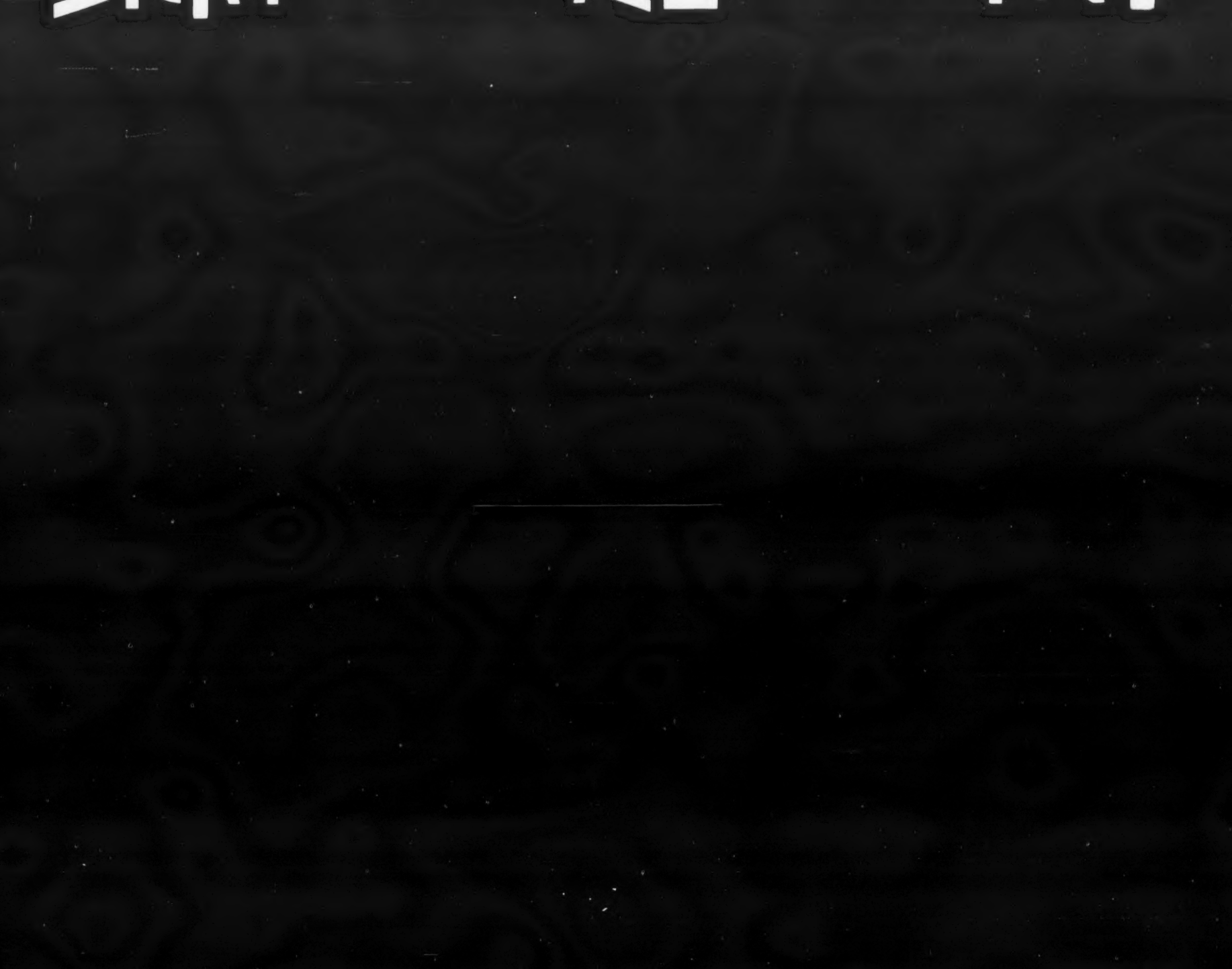
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